Number 17 Series 1924

UNITED STATES DEPARTMENT OF AGRICULTURE
BUREAU OF CHEMISTRY AND SOILS
In Cooperation with the State Soil Survey Department
of the Conservation and Survey Division, University of Nebraska

SOIL SURVEY
OF
GARDEN COUNTY, NEBRASKA

BY
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U. S. Department of Agriculture
and H. E. WEAKLEY, and E. H. STRIETER
Nebraska Soil Survey

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UNITED STATES
GOVERNMENT PRINTING OFFICE
WASHINGTON
1929

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By LOUIS A. WOLFANGER, in Charge, and A. W. GOKE, United States Department of Agriculture, and H. E. WEAKLEY and E. H. STRIETER, Nebraska Soil Survey

COUNTY SURVEYED

Garden County is in the eastern part of the "panhandle" of Nebraska. Oshkosh, the county seat, is 351 miles, by rail, west of Omaha. The county is nearly rectangular in outline. It extends 54 miles from north to south, but the northern boundary is 31 miles and the southern boundary 29 miles in length. The area included is 1,687 square miles or 1,079,680 acres.

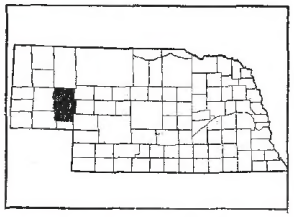

FIG. 1.—Sketch map showing location of Garden County, Nebr.

Garden County is a part of the Great Plains, occurring in the eastern part of what is known as the high plains. The county comprises a constructional plain which has been formed by the deposition of sediments brought down from the Rocky Mountain region to the west during the late Tertiary period. The original plain was broad and comparatively smooth and sloped gently toward the east. Under the aggressive erosion of wind and water and the development of the North Platte drainage system, only about 20 per cent of the county has retained the features of the ancient plain. The constructional plain remnants consist of two main areas separated by the valley of North Platte River. The southern area lies south of North Platte River and is designated by the State survey as part of the Cheyenne table. This area is almost flat or very gently rolling and includes a few valleys of intermittent streams, a large number of shallow depressions, and numerous low hills and mounds, very few of which are more than 20 or 30 feet above the general level of the surrounding lower lying areas. The numerous shallow basins or depressions of the table-land are without drainage outlets, so that the water which gathers in them can disappear only by evaporation and slow percolation.

In the central and eastern parts of the Cheyenne-table section of the county there are ridges of loess rising from 50 to 60 feet above the general level of the table. The central loess body, which extends southward into Deuel County, consists of an isolated ridge standing on the plain. The eastern loess body is the western part of a larger body which is continuous into Keith County but which has been removed from the spur between the valleys of North Platte and South Platte Rivers. This body has a comparatively smooth surface in the southern part, but the northern edge and the central loess ridge break into tongues which cap the interstream areas between the precipitous-sided drainage ways leading northward to the North Platte River.

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Although the upland in the northern part of the county lies at about the same elevation as that in the southern part, its relation to the original plateau is not so obvious. The surface of the high plain is more eroded along its southern border, and the highest part farther north, though level in general appearance, is composed of a sheet of sand upon which has developed a dune sand relief. The surface features of the dune sand area are common to the region of the sand hills, of which dunesand forms the southern extension. Areas are characterized by a monotonous succession of sharply rolling hills and irregular ridges, in places capped by drifting sand and pitted by blow-outs and having a northwesterly-southeasterly trend. The billowy surface is relieved here and there by level valleys or basins of different sizes, most of whose outlets are obstructed by sand dunes.

The southern part of the northern uplands of the county is rolling and is crossed by numerous drainage ways, most of which have rounded slopes covered in part by sand dunes. In the southeastern corner of the county the slopes are capped by somewhat dissected loess areas extending eastward into Keith County. Blue Creek divides the northern uplands into two minor plains. In the southwestern part of the northern plains bordering Blue Creek a series of bluffs mantled with patches of gravel crop out under the loess. Such bluffs in the Morrill County survey were designated as remnants of a series of alluvial-fan deposits differing in size and varying in stage of decay. Similar deposits in the sand hills and in central Perkins County indicate that these materials are in part, at least, residual and are derived from the underlying bedrock.

North Platte River flows in a southeasterly direction and is bordered by a small band of alluvium. The river deposits occur at several levels, extend from the bed of the stream itself to the present limit of overflow, and range in width from a few rods to more than 1 mile. Most of the terraces above these alluvial lands are level, broken in places by old stream channels and depressions. The terraces border the flood plain and extend for considerable distances up the larger tributaries.

Garden County ranges in elevation from 3,260 feet above sea level near the point where North Platte River leaves the county to 4,080 feet on the western uplands. The general slope of the upland plain is southeastward. The loess ridges stand about 60 feet above their borderlands. The average elevation of the table-lands is about 3,700 feet above sea level. The most abrupt relief occurs along the south side of North Platte Valley between the edges and remnants of the south table-lands and North Platte River. The drop is from an elevation of 3,700 feet above sea level on the highlands to 3,300 feet on the river not more than 2 miles distant. The descent from the uplands on the north side of the valley is, in general, more gradual.

The water supply throughout the greater part of the county is adequate. In the valleys of North Platte River, Blue Creek, and other creeks, most of the water is obtained from wells from 10 to 40 feet deep. On the table-lands the water table lies at the base of the Ogallala and Arikaree formation, and many wells range in depth from 100 to 300 feet. The volume of water seems to be large in nearly all localities. In places, water is obtained high up in the formation, but the principal supply is in the basal beds. Along

the margins of the table-lands water comes to the surface in the form of small springs which flow into the drainage ways.

Garden County was organized in 1910 from an area which formerly included Deuel and Garden Counties. Early settlement was made at the same time and in the same way as in the neighboring counties. The greater percentage of the population came from eastern Nebraska, but a few settlers came from eastern States. Out of 4,290 native-born whites only 960 are of foreign or mixed parentage, and there are only 275 foreign-born whites in the county. The total population of Garden County in 1920 was 4,572, an increase of 1,034 since 1910. Most of the inhabitants lived in the towns in the valley of North Platte River. In the southern part of the county the population is rather evenly distributed, but in the sand hills it is sparse and scattered. Oshkosh, the county seat, is in the south-central part of the county, on a branch line of the Union Pacific Railroad. It had a population of 707 in 1920. Lisco and Lewellen are other towns of local importance on the same railroad.

The North Platte and South Torrington branch of the Union Pacific Railroad serves the county. Parts of the county are 25 or 30 miles from a shipping point. The main line of the Union Pacific Railroad, to the south of the county, receives a part of the trade from the southern part of the county, as Lodgepole, in Cheyenne County, and Chappell, in Deuel County, are more accessible towns than Oshkosh and Lewellen on the branch line in North Platte Valley.

Wagon roads follow section lines where this is possible, but the highways in the valleys and those in the rough and erroded sections avoid natural obstructions and conform to the surface relief. The main roads are in fair condition, but the less important roads receive very little attention. A State highway passes east and west along North Platte Valley and where improved is in good condition for both wagon and automobile traffic. Improvements are in progress and will eventually include the entire road. Gravel is abundant in some sections of the county, and sufficient sand and clay are available for improvement of most of the highways.

Garden County has several rural mail routes, and all important points are reached by telephone. The rural schools are fairly good, and graded schools are maintained in the towns. The county high school is located at Oshkosh. A joint consolidated school district in the southwestern part is maintained with Deuel County.

The principal local markets are Oshkosh, Lewellen, and Lisco. Some products are handled at Chappell, in the adjoining county to the south. Sugar beets are grown on contract and are shipped to sugar factories in Scotts Bluff and Morrill Counties. Beet dumps are maintained at Lytle, Penn, and Lutherville. Wheat is delivered to local elevators in the railroad towns. The principal outside markets for the agricultural products of the county are Omaha, St. Joseph, Kansas City, and Denver.

CLIMATE

The climate of Garden County is characterized by long, cold winters and short, hot summers. The mercury frequently rises above 100° F. and often falls below zero. The low winter temperatures occur as cold waves and blizzards, often of several days' duration. These cold spells and blizzards at one time were very damaging to

unsheltered livestock, but with greater care given the range cattle these losses have been considerably reduced.

The distribution of rainfall is vital, as the precipitation consists mainly of local showers and is extremely variable. The rains are frequently in the form of thunderstorms and are sometimes torrential. Hail occasionally does serious damage in places. Crop yields are often curtailed by drought, which may cause total failure unless, as many farmers of the county believe, summer tillage is practiced.

The prevailing wind is from the northwest, except during the summer months when the winds are mainly from the southeast. High winds are common throughout the year, but tornadoes are rare.

The climate in this county is the principal controlling factor in the agricultural development, as most of the tillable lands are fertile. It restricts, in various ways, the variety of crops grown and decidedly affects the cultural methods practiced. Owing to the low average rainfall and its variable distribution, the severe winters, and the short frost-free seasons, chiefly only early-maturing and drought-resistant varieties of crops can be profitably grown unless the land is irrigated. Corn occasionally fails to mature, though the frost-free season in many years is sufficiently long to mature other crops properly acclimated. Few planted trees thrive unless given much attention, and the native trees, except for some growing along the river bottoms, are scattered and scrubby.

The records of the Weather Bureau station at Oshkosh are given in the following table. These figures are for a period of 12 years and are fairly representative of climatic conditions in the county.

Normal monthly, seasonal, and annual temperature and precipitation at Oshkosh

[Elevation, 3,393 feet]

Month	Temperature			Precipitation			
	Mean	Absolute maximum	Absolute minimum	Mean	Total amount for the driest year (1921)	Total amount for the wettest year (1923)	Snow, average depth
	° *F.*	° *F.*	° *F.*	*Inches*	*Inches*	*Inches*	*Inches*
December	24.7	62	−17	0.68	0.37	0.45	8.2
January	24.5	62	−23	.39	1.12	.19	5.7
February	27.5	71	−20	.56	.60	.15	8.3
Winter	25.6	71	−23	1.63	2.09	.79	22.2
March	37.6	79	−5	.86	.45	1.13	5.5
April	46.7	88	6	2.78	.60	2.20	8.8
May	57.6	93	25	3.08	3.20	6.20	3.7
Spring	47.3	93	−5	6.72	4.25	9.53	18.0
June	68.2	101	34	2.07	1.43	2.87	.0
July	74.0	102	37	2.60	1.94	2.62	.0
August	70.9	100	41	2.78	1.07	5.99	.0
Summer	71.0	102	34	7.45	4.44	11.48	.0
September	62.9	97	23	1.44	.75	1.27	Trace.
October	49.2	86	8	1.31	1.14	4.63	1.6
November	37.7	77	−21	.67	.61	.57	4.6
Fall	49.9	97	−21	3.42	2.50	6.47	6.2
Year	48.5	102	−23	19.22	13.28	28.27	46.4

AGRICULTURE

The early history of Garden County is connected with the Oregon Trail and other western trails. In the early rush to the coast States, the country was rapidly passed over by settlers. Because of overgrazing on the part of the cattlemen who occupied the country in part and because of false settlement of certain lands, the area appeared poor and unattractive. The Oregon Trail crossed the south divide from Big Spring, dipped into Ash Hollow, and entered North Platte Valley, which it traversed westward. Its general course is marked by several monuments.

The early agriculture consisted of ranching. The herds were driven to the railroads and shipped to the big cattle markets, principally Chicago. Large profits were realized as long as the range was free, as the nutritious grasses afforded good pasturage. The free-range cattle barons held sway until 1889 when the last round-up was held and fencing began.

Settlement on the south table was among the earliest, the settlers coming northward from the main line of the Union Pacific Railroad in Deuel County, of which Garden County was then a part. The greatest influx occurred during the years 1885 and 1886. The passage of the herd law in 1887 forced most of the large cattle owners out of the country and broke up the large ranch holdings. Waves of settlement advanced and receded, as in other parts of the Great Plains. The early settlers had a few good crops and immigration was correspondingly augmented. Following this tide of rapid settlement, there came a series of dry years culminating in disastrous droughts in 1893 and 1894, when a total failure of crops caused many settlers to leave the county. It is probable that the development would not have been so seriously checked had the dry-farming methods of to-day been understood at that time. Present-day conservation of soil moisture by cultivation and the development and adoption of acclimated varieties of crops have, in a measure, overcome the adverse climatic conditions.

The Kincaid Act, which increased the homestead to 640 acres, served to bring in additional settlers and to improve general farming conditions. With the passage of this act in 1905, farming operations were revived and combined stock raising and farming proved profitable. Crops produced consisted chiefly of forage and subsistence crops raised in connection with dairying. The sale of butter, milk, and eggs served to supply many farmers with daily living expenses.

Before 1916 the irrigable strip of alluvial land on the north side of North Platte River was little cultivated. Irrigation canals were operated in preceding years, but the water was diverted upon meadows for the purpose of increasing the yield of native grasses. Later development, however, has included sugar beets and alfalfa as profitable cultivated crops.

The sand hills region is sparsely populated. The enactment of the Kincaid Act brought in numerous settlers, many of whom sold their land as soon as they obtained title, so that much of the land is held in large areas. Cropping was tried in many of the more level basins of the hills, but wind erosion has depleted the loose soil to such an extent that in a number of areas it is difficult for native vegetation to again establish itself and fit the land for pasture.

Following demands for increased production and after the greater perfection of motor machinery, big farming was inaugurated on the south divide in 1915. This type of operation has been steadily promoted, so that a large part of the table-land is now farmed by people from eastern Nebraska. These farmers have been attracted by the extensive level plains and the suitability of the land for the use of tractors and other power machinery.

About 63 per cent of the area of Garden County was included in a total of 835 farms in 1910. A considerable amount of the land is now under cultivation. In 1913, 29,251 acres were under cultivation; by 1920 this acreage was increased to 73,150 acres.

The following table shows the acreage and average acre yields of corn, wheat, and other important crops for the years 1913 to 1920, inclusive, according to the annual report of the Nebraska State Board of Agriculture:

Acreage and acre yields of the principal crops, 1913 to 1920, inclusive

Crops	1913		1914		1915		1916	
	Acreage	Average yield per acre	Acreage	Average yield per acre	Acreage	Average yield per acre	Acreage	Average yield per acre
	Acres	*Bushels*	*Acres*	*Bushels*	*Acres*	*Bushels*	*Acres*	*Bushels*
Winter wheat	1,410	21.8	2,119	26.2	4,751	24	4,602	16.5
Spring wheat	7,825	15	2,998	17	2,611	20.5	2,960	12.6
Corn	17,416	20	11,698	30	11,445	20.3	8,277	23.3
Barley	187	22	118	28.4	109	20	80	20
Oats	2,500	33	1,672	30	1,680	30	1,663	27
Rye	2,084	26	1,137	20	1,453	19.4	736	15
Spelt	1,120	27	387		224		482	
Potatoes	801		343	100	464	107	287	75
		Tons		*Tons*		*Tons*		*Tons*
Alfalfa	2,543	3	2,848	4	1,753	3.3	2,554	2.6
Wild hay	4,807	1	3,630	1	16,194	1	7,796	1
Millet and Hungarian grass	973	2.2	723		447		191	
Sugar beets	3				8		531	
Sorghum	220	5.5	58		247		90	

Crops	1917		1918		1919		1920	
	Acreage	Average yield per acre	Acreage	Average yield per acre	Acreage	Average yield per acre	Acreage	Average yield per acre
	Acres	*Bushels*	*Acres*	*Bushels*	*Acres*	*Bushels*	*Acres*	*Bushels*
Winter wheat	3,229	13	8,781	14	24,213	19	24,957	15
Spring wheat	4,965	17	3,781	10	2,473	12	1,671	10
Corn	16,500	25	14,551	21	21,519	21	29,348	26
Barley	449	20	330	24	450	22	855	29
Oats	2,681	24	2,710	20	21,432	30	3,067	31
Rye	1,695	11	3,050	13	3,055	11	2,702	15
Spelt	785		988		278		190	
Potatoes	565	98	475	122	728	62	679	120
		Tons		*Tons*		*Tons*		*Tons*
Alfalfa	3,157	3	3,543	2.5	4,120	2.9	4,647	2.4
Wild hay	19,520	1	3,567	1	43,084	0.8	21,697	1.0
Millet and Hungarian grass	650		310		723	2	889	1.7
Sugar beets	75		1,350		1,600		1,760	
Sorghum	195		20		793	3	911	2.2

The agriculture of the county consists of (1) grain farming, (2) growing sugar beets and accessory irrigated crops, (3) a combined system of grain growing and cattle ranching, and (4) cattle ranching. Large areas of the level table-land of the south divide, the Lisco table-land, and of the tillable sand-hill valleys are used for grain production. The rest of the uplands, including the sand hills and sandier regions, the rough areas adjacent to North Platte Valley and tributary valleys, and the areas of slope and eroded lands are used for grazing beef cattle and horses and for the production of hay and grain for feed. Large tracts in the valley of North Platte River and small areas along other perennial streams are under irrigation, and sugar beets, corn, and alfalfa are the important crops. Strict cattle ranching is conducted exclusively in the sand hills of North Platte River, though a number of these ranchers produce corn, hay, rye, and other crops for winter feed. A few garden vegetables are produced for home consumption on nearly every farm and on many of the ranches.

Wheat, the principal cash crop in the hard dry-land farming sections, is the most important grain crop in that section but ranks second in acreage in the county. During 1920, according to the annual report of the State department of agriculture, 26,628 acres were devoted to this crop. Almost 94 per cent of this acreage was planted to winter wheat, only 1,671 acres being in spring wheat, whereas in 1913 the acreage of winter wheat was less than one-fifth that of spring wheat. The acreage of winter wheat did not surpass that of spring wheat until 1915. Most of the wheat is grown on the heavier soils, because on the sandier soils there is considerable danger of soil drifting by the heavy winds of spring and fall. Winter wheat is preferred to spring wheat, as winter wheat ripens before the coming of the hot winds and low rainfall in summer. Wheat is generally sown before September 1, but many farmers continue sowing until the first of October. The crop is either cut and threshed from the shock or is cut with the combined harvester-thresher, which performs the cutting and threshing operations at the same time and returns the straw directly to the ground. A few farmers prefer heading. A small part of the crop is ground into flour and used locally, but most of it is shipped to outside markets, principally Omaha. Some of the grain is sold through cooperative associations.

Yields of wheat are largely dependent on climatic conditions and vary considerably from year to year. However, it is believed by many progressive farmers that summer tillage of fallow lands tends to offset unfavorable climatic conditions. Many farmers have inaugurated this method, but a number are defeating their purpose by allowing Russian thistles, sunflowers, and other weeds to infest the fields and take up the surplus moisture nearly as fast as it accumulates. Over most of the county the matter of careful preparation of the seed bed is given little attention. The average production of winter wheat to the acre for the last eight years, as computed from the records of the Nebraska State Board of Agriculture, is 18.7 bushels. Between 10 and 15 bushels to the acre is considered a good average. The acreage in winter wheat in 1920 was more than seventeen times as great as that in 1913, whereas the acreage in spring wheat declined to about one-fifth of what it formerly was. The

average yield of spring wheat for the period from 1913 to 1920 was only 14.3 bushels to the acre. This is much less than that of winter wheat. Turkey is the leading variety of winter wheat though Kanred is popular with some farmers.

Corn surpasses wheat in acreage and is important especially on the sandy soils and under irrigation. The State Department of Agriculture reports 29,348 acres in corn in 1920, with a total production of 763,048 bushels. Warm dry winds and droughts in some years cause considerable damage to this crop, but owing to the higher available moisture in sandy lands this danger is materially reduced on such soils. Owing to the high altitude, the shortness of the growing season, and cool nights at critical periods, the kernels are often soft and immature. The early settlers paid no attention to climatic adaptation of the crops grown, so that their success with corn was only partial. Now hardier, fairly early varieties have been introduced and are giving better results. These varieties produce smaller stalks and ears than the varieties grown in the eastern part of the State, but a matured crop is more assured. The seed is generally saved from each crop for the succeeding one, and little attention is given to the finer points of seed selection. Some farmers grow corn successively on the same ground for years with little appreciable decrease in yield. The grain is fed to hogs, cattle, and horses. A few farmers grow more corn than they need and sell the surplus.

In 1920 oats were grown on 3,067 acres and gave an average yield of 31 bushels to the acre. Most farmers do not consider oats a profitable crop, but it is needed to feed the livestock, especially horses, and is valuable in rotations. Oats do not withstand droughts as well as the other small grains and in many years are damaged by warm, dry winds, droughts at heading time, and grasshoppers. The crop gives best results on the heavier soils. Oats may follow corn when it is desired to change the field to wheat the succeeding season. It is rarely grown for two successive years on the same land. Yields are very uncertain, but in the best years from 40 to 50 bushels to the acre are obtained. In the drier years many of the heads fail to fill well, and the crop is used for forage. Most of the crop is cut with the binder and threshed from the shock.

When rye is to be allowed to mature for the grain it is sown on the heavier soils; when it is grown for hay and pasturage it is sown on the sandy soils, especially in the sand hills. The acreage grown for hay and pasturage has substantially increased in the last year. The yield varies from 15 to 30 bushels of grain to the acre, depending on the rainfall. The crop resists drought fairly well. It yields better on the sandy soils. It makes an excellent early feed for cattle before the native grasses are fit for use.

Barley was grown on 855 acres in 1920. Yields varying from 20 to 30 bushels to the acre are reported in the last eight years. Although the crop is hardier than oats, damage is caused by grasshoppers. Very little barley is marketed.

The sugar-beet acreage in 1920 was 1,760 acres. This crop is grown only on the irrigated lands of North Platte Valley. The yields range from 10 to 15 tons to the acre, with an average of 12 tons. The tops are used locally for feed for livestock.

Sorghum, millet, barley, and potatoes constitute the less important crops. They are grown in small patches on many farms. Sudan grass, grown to a small extent, gives good results and probably could be used extensively for forage. Potatoes and vegetables are grown mainly for home use. The vegetables require irrigation. A few small orchards of apples, cherries, and other fruits are scattered over the county, but with the exception of cherries, the fruits are not profitable owing to unfavorable climatic conditions, late spring frost preventing the setting of fruit, and severe winters and droughts injuring the trees. Among the small fruits strawberries and gooseberries do well but are not produced commercially. Watermelons and allied fruits yield well and are of excellent quality. Of the wild fruits, chokecherries, sand cherries, plums, and grapes are the most important and are very abundant in favorable seasons.

Alfalfa, the principal leguminous crop in the county, occupies fourth place in acreage. On account of its value for feeding livestock, it is one of the most important forage crops produced. The crop was grown on 4,647 acres in 1920, and the average yield was 2.4 tons to the acre. Most of the alfalfa is grown on subirrigated bottoms and the irrigated benches of North Platte River and its perennial tributaries. A small acreage has been planted on the uplands where the crop appears to be thriving, but under these conditions rainfall is the controlling factor. Two cuttings are possible in favorable seasons.

In 1913 wild hay exceeded all crops, except corn and wheat, in acreage; in 1920 the total acreage was 21,697 acres. As a source of feed for livestock, wild hay ranks next to alfalfa. The yield ranges from less than a ton to 1½ tons to the acre. The chief varieties of grasses are stipa or needle grass (*Stipa comata*), sand grass (probably *Calamovilfa longifolia*), buffalo grass (*Bulbilis dactyloides*), bunch grass (little bluestem, *Andropogon scoparius*), grama grass (*Bouteloua oligostachya*), a sedge blackroot (*Carex pennsylvanica*), slender wheatgrass (*Agropyron tenerum*), big bluestem (*Andropogon provincialis*), Redfield's grass (*Redfieldia flexuosa*), salt grass (*Distichlis spicata*), switch grass (*Panicum virgatum*), and some marsh grasses such as spartina. The larger yields are obtained in North Platte Valley where big bluestem makes a luxuriant growth. In the uplands the yields range from one-fourth to three-fourths ton to the acre depending on the rainfall. The greater part of the crop is fed during the winter months to work animals and cattle.

The raising and feeding of livestock, combined with grain farming, is an important industry in some parts of the county, particularly on those farms which include areas of land unsuited for cultivation. In the sand-hill region the land in general is unsuited to crop production and is included in large livestock ranches, on which hay or rye and similar crops are grown for forage. The smooth table-lands are devoted almost entirely to grain production and the maintenance of work, dairy, and beef animals. According to the census, on January 1, 1920, there were in Garden County 10,683 horses, 364 mules, 51,292 cattle, 16,420 hogs, 1,278 sheep, 25 goats, and 47,701 chickens and other poultry.

Most of the cattle produced are shipped as stockers and feeders to Omaha. As a rule pasturage on dead grasses during the winter has

been supplanted by feeding during the severe seasons. The most popular breeds are the Hereford and Shorthorn. Very few of the animals are purebred, but the herds are usually sired by purebred bulls. This practice has greatly improved the quality of the stock in recent years. The stock is usually sold when two or three years old. According to the census, cattle in Garden County in 1920 had a value of $2,528,457. There are several dairy herds consisting of grade animals. The dairy products are marketed locally. As in other western sections, the dairy industry has proved a valuable adjunct where it has been properly developed, and the building up of purebred herds in this county would materially increase the returns.

Hogs are raised on a small scale on many farms, but low market prices the last few years have somewhat discouraged those engaged in the industry. Most of the animals are fattened on corn or fed alfalfa on the irrigated, subirrigated, and on some of the upland farms.

A small flock of poultry is raised on nearly every farm, and a few farmers have a surplus of products for sale. Small numbers of turkeys, geese, and ducks are raised.

In general the horses raised on the uplands are inferior animals, but those in the valleys and sugar-beet sections are good. They are of a light-draft type, weighing from 1,000 to 1,200 pounds. Belgian and Percheron are considered the best grades for local use.

Sparse growths of black willow, sand-bar willow, almond-leaved willow, cottonwood, white elm, blackberry, and wild plum flourish in the North Platte Valley and a few tributary valleys, and the rough broken areas support a scrubby growth of western red cedar and western yellow pine. The uplands are sparingly dotted with small tracts of ash, box elder, and other trees, but unfavorable climatic conditions have resulted in small stubby growths.

The Russian thistle and dwarf sunflower are abundant, and other noxious weeds are widely distributed over the county. In some seasons the locust, or grasshopper, and the variegated cutworm are pests, and wheat rust and corn smut are injurious diseases.

Both surface features and soil conditions have closely influenced the extent and distribution of the various crops. The heavier, more level soils of the high table-lands are well adapted to the production of small grains, and the alluvial soils of the terraces and first bottoms along the larger streams, where the soil is slightly more moist than on the upland on account of its flat surface and low position, produce the highest yields of sugar beets, corn, alfalfa, and native hay. Corn is the principal crop on the subirrigated bottoms and the sandy soils of the valley lands. Sugar beets are produced only under irrigation. In general, the heavier and deeper soils, including the very fine sandy loams, loams, and silt loams, are recognized as best suited to small grains. In the irrigated areas, the finer textured soils with the deepest and least pervious subsoils are selected for the special crops. The areas of rough and eroded lands, the sand dunes, and the large areas where the underlying rock is close to the surface are best adapted to grazing. The poorly drained flood plains along North Platte River and its tributaries are used exclusively for the production of hay and for pasture, and the better drained areas of the first bottoms are well adapted to alfalfa. Corn is grown in all parts of the county but seems to do best on the lighter textured soils.

Fields on northern slopes are considered better for corn and those on southern slopes for wheat, but the matter of situation is disregarded by most farmers. In dry seasons, corn and other crops produce better yields on the rounded slopes and valley sides than on the flat uplands.

Owing to the low rainfall and its variable distribution from year to year certain cultural methods not practiced in the more humid parts of the State are necessary for success here. On the unirrigated lands dry-farming methods are uniformly carried out. The essential features are thorough preparation of the land and the conservation of soil moisture. The sandy lands are not plowed deeply and are not cultivated so intensively to form a mulch as are the heavier soils. Soils which blow readily are not summer tilled, because high winds cause the soil to drift. The common practice is to cultivate following a rain sufficiently heavy to destroy the mulch. During periods of prolonged drought some farmers think it necessary to cultivate between rains. As much moisture is lost through weeds, frequent cultivation to destroy such vegetation is especially urged for thorough and proper summer tillage. A rather rough surface is advantageous on the heavy soils, as it aids absorption and prevents water from running off during heavy rains. The heavier soils hold more moisture than the sandy ones, but the moisture is less available for crop use. Moisture conditions are the chief factors controlling cropping and rotation, fertilization and tillage methods being of secondary importance.

On the whole, farm improvements are good on the south table-land. Practically all farms are equipped with modern labor-saving machinery, and the buildings, as a rule, are well constructed. Portable bunk houses are a feature of sod-land farms. The equipment on many farms consists entirely of tractors and tractor-drawn implements suited for farming on an extensive scale. Some farmers use the tractor for heavy work and horses for general farm operations. On the divides, the horses are of light or medium weight, the tractor having decreased the demand for heavy animals and the automobile for light animals. In 1920 there were 49 trucks, 305 automobiles, 87 gas tractors, and 84 gas engines on the farms. Equipment in other sections of the county is variable, depending on the stage of development and type of agriculture, but cultivators, mowing machines, and stackers are in common use. Sod houses are found in the sand hills and some other sections of the county, and most of the farm buildings are small and roughly built. The fences are practically all of barbed wire and most of them are in good repair. Much of the south divide has come under fence only in recent years, and large tracts are still open.

No commercial fertilizers are used and but little of the manure produced on the farms is applied to the land. The application of manure on sandy lands tends to increase the humus content, to check blowing, and to increase production.

Although efficient farm labor is rather scarce, there is usually sufficient help available to supply the necessary labor during harvest. At other times most of the farm labor is performed by the farmer and his family. Most of the farm laborers are Americans, but a few Germans, Russians, and Mexicans are employed in the production of

sugar beets, both for wages and on the share plan. In 1920 few men were hired by the year. Day laborers were paid from 50 to 70 cents and board, those laborers operating trucks or tractors commanding the higher wage. Some farmers and ranch owners employ entire families, giving them in addition to the wages the use of a house, garden, cows, and chickens. Contract labor is employed in sugar-beet production.

In 1920, according to State reports, 1,067,765 acres were in farms in Garden County. Of this area 73,150 acres were under cultivation. The total irrigated land was 7,651 acres. The average farm contains from 320 to 640 acres, but in the strictly grazing and hay-producing sections the ranches comprise 640 acres and upward.

By far the greater part of the farmers and ranchers own their land. In 1920, 69.6 per cent of the farms were operated by the owners. Of the tenant farms, 22.4 per cent are rented for cash and 77.6 per cent on shares. The owner customarily receives one-third of the crop, delivered at the elevator. The tenant furnishes seed, labor, and equipment.

On account of the newness of the county and the inflated values it is difficult to fix land values accurately, but the following valuations are based on estimates of reliable farmers. The best grades of upland on the south divide range in value from $65 to $135 an acre, depending chiefly on the location and improvements. The sand-hill areas range in value from $10 to $15 an acre, but are generally sold in conjunction with neighboring land of higher value. Along the North Platte River and Blue Creek, the terrace and first-bottom land adapted to irrigation ranges in price from $100 to $200 an acre. The current value of rough broken land is from $10 to $25 an acre. According to the 1920 census, the average acre value of land in Garden County was $19.98.

SOILS

Garden County is in the prairie region of the United States. The soils have developed under the influence of a native vegetation of grasses. Although the supply of moisture is too low to favor the accumulation of as large amounts of organic matter as exist in the soils of the prairies farther east, the quantity is sufficient in the undisturbed soil to give it a dark-brown color. The average annual rainfall is too low to allow the leaching of the entire soil, so that the carbonates are leached from the surface layers but are abundant in the lower part of the subsoil. In their development, the well-drained soils of the upland have, on account of climatic forces, acquired a uniformity of color and structure of material. They present fewer differences in characteristics than do the parent materials. This is shown by the similarity of the soils which have developed from materials originating from the sandy shales of the Arikaree formation and from the loess. They have the same color, and the soil profiles are so much alike that their differentiation was very difficult. The soils of the higher terraces have reached a stage of development in which they closely resemble the upland soils, so that it can hardly be said that they differ, except in surface features.

The important characteristics of the soils, therefore, are determined to a very large extent by weathering under conditions of low rainfall.

The mature soils are rather dark brown in the surface horizon, and their subsoils are brown or light brown in the upper part and gray or pale yellow in the lower part. The surface soils, in general, are granular or friable and are underlain by moderately compact, granular subsoils. The upper part of the subsoils in some soils consists of much more compact material than that composing the surface soils. The lower part of the subsoils, in areas in which normal weathering occurred, are calcareous at a depth of 24 inches. On flat areas in the loess region and in basins, leaching has been so active that no reaction for lime carbonate was obtained to a depth of 3 feet.

The material in large areas of wind-laid sand and that of some of the more recently formed colluvial deposits either has not been weathered sufficiently to develop a profile like that of the heavier upland soils or, because it is composed largely of quartz sand, it loses its soluble salts so readily that it does not develop such a soil profile.

The sedimentary rocks over which the Rosebud soils have developed belong to the Ogallala formation of late Tertiary age. The surface strata of the country rock on the high plains consist of fine sandstones and shales which contain a high lime content. In well-drained areas these rocks weather into silt loams and fine sandy loams which have the characteristic Rosebud profile. Variations of the texture of these soils bear a close relation to different lithologic phases of the Ogallala and Arikaree formations.

The Dawes soils have developed under conditions that favored a more thorough leaching and compaction of the subsurface layer. The same condition in the flat-bottomed basins has resulted in the development of the Yale soils.

Where erosion has been severe the white carbonate layer is absent, as sufficient time has not elapsed for its formation. In such areas the soil to bedrock is like the brown surface layer. Such soils are classed in the Canyon series.

The loess soils have the general characteristics of the soils derived from the older formations. Keith silt loam is a product of the weathering of loess in an undisturbed condition on the upland. Developed under the same conditions as the Rosebud soils, it has the same general profile.

The Colby soils occur on slopes where the rapid removal of the soil by erosion has not allowed the development of the Keith soils.

The large dune sand areas include wind-blown sand which has been eroded in comparatively recent times, and much of which is still in motion or subject to shifting. The porous sand has allowed the leaching of all soluble salts as soon as they were released by weathering, and with the exception of the small amount of organic matter which has accumulated in the sands that were stationary for some length of time no change has taken place in this sand since its deposition. Some areas of wind-laid sand, however, have held a stationary position for some time, and the breaking down, by weathering, of the feldspar and minerals other than quartz has resulted in the incorporation in the surface of these dunes of sufficient fine material to give a loamy texture to the soil. Soils formed in this manner have been classed in the Valentine series.

The alluvial soils occur in various stages of development. The Tripp and Cheyenne soils occupy high terraces and have reached

the same stage of maturity as the soils of the upland. The Tripp soils have profiles like those of the Rosebud. The Bridgeport soils are new soils which do not have any lime accumulation in their subsoils. The Laurel and Sarpy soils comprise first-bottom lands which are formed of recently deposited alluvium. They have not developed distinct layers nor has much organic matter accumulated in them.

The soils of Garden County have been grouped into series on the bases of color, structure, details of the soil profiles, and source of the parent materials. Each series includes soils differentiated on the basis of the texture of the surface layer.

The Rosebud soils have moderately calcareous topsoils which vary from dark gray to brown. The subsoils are highly calcareous, are whitish in color, and are floury in texture. A characteristic feature is the light-gray or almost white color of the deeper part of the subsoils. The Rosebud soils have developed on the light-colored, calcareous, unconsolidated Tertiary deposits of the high plains. The Rosebud gravelly sandy loam, fine sandy loam, very fine sandy loam, deep phase, loam, with a deep phase, and silt loam, with a deep phase and a rolling phase, are the members of this series mapped in Garden County.

The Keith soils have dark-brown surface layers and dark-brown or brown subsurface layers. In virgin areas the second layer has the rather compact, granular structure which is typical of prairie soils of subhumid climates. The color fades gradually downward and finally grades to pale yellowish gray, the color of the parent loess from which the soils have developed. The Keith soils differ from the Colby in the greater depth and darker color of the surface and upper subsoil layers. Keith silt loam is mapped in Garden County.

The Colby soils have topsoils which vary from ash gray to brownish gray and which grade abruptly to light-yellowish or whitish, floury, highly calcareous subsoils. They have developed from loess, and are porous. The material in the surface zone has been considerably weathered and slightly modified by wind action. In this survey, Colby very fine sandy loam, with a broken phase, and Colby silt loam are mapped.

The Valentine soils are characterized by brown or dark grayish-brown topsoils and by subsoils which are brown or dark brown in the upper part and light brown or yellowish brown in the lower part. The subsoils are friable and only moderately compact, and grade to loose sand at a depth varying from 2 to 3 feet. A characteristic feature is the absence of calcareous material. The Valentine soils occur in level or gently rolling valleys and basins where their position has favored the accumulation of organic matter. The materials are probably composed of particles carried from alluvial lands and of partly weathered wind-blown material originating from the underlying Tertiary sandstone. The material has been so shifted by wind and water and subsequently weathered that it has lost most of its original characteristics. These soils differ from the Rosebud soils in the absence of the light-colored subsoil and in their lower lime content. In this county the sand, loamy sand, loamy fine sand, fine sandy loam, and very fine sandy loam members of the series are mapped.

The Gannett soils have dark grayish-brown or black surface layers which contain a large amount of organic matter; the organic material in many places is so abundant as to almost produce a muck. The subsoils consist of light grayish-brown or grayish-white incoherent sandy loam or sand which generally grades, at lower depths, to the same material that underlies the dune sand areas. In places a thin substratum of heavy sandy clay is present below a depth of 36 inches. The Gannett soils have developed in pockets or swales in the sand-hill region. They have weathered from wind-blown material mixed with fine material washed from the hills and modified by the incorporation of organic matter. Gannett fine sandy loam and Gannett loamy sand are recognized in Garden County.

The Scott soils are dark brown or almost black in color, and are refractory and heavy in texture. The upper part of the subsoils varies from dull-brown to black silty clay which grades downward to stiff, compact, almost black clay. The subsoil is sticky and plastic when moist, but hard and brittle when dry. In the loess region the subsoil material ordinarily grades downward to light-yellow or ash-gray silt loam which is similar to that of the subsoils of the Keith and Colby soils. Both topsoil and subsoil have a bluish-gray cast when thoroughly dry. The soil material consists of lacustrine sediments originating from the higher lying soils and deposited by water in temporary ponds which occupy the shallow undrained depressions in the uplands. Scott silty clay occurs in the county.

The topsoils of the Canyon soils vary from brown to grayish brown, and the subsoils are yellowish gray. Both topsoil and subsoil contain fragments of partly disintegrated, soft, calcareous conglomerate of the Tertiary mortar beds. The members of the series are mainly residual from the calcareous conglomerate, sands, and silts of the Tertiary formation. These soils differ from the Rosebud soils in not having the carbonate of lime accumulation in the subsoil. In Garden County the Canyon series is represented by the gravelly sandy loam, loamy fine sand, and loam members.

The Dawes soils vary in color from grayish brown to dark brown. The upper part of the subsoil in most places varies from brown to dark brown. It is moderately friable and compact and is heavier in texture than the surface layer. At a depth varying from 20 to 30 inches, the subsoil grades to material which is light gray, highly calcareous, and silty or chalklike when dry and which is similar to the silty material present in the Rosebud soils. A marked feature of the members of the Dawes series is the leached soil. Nearly all the lime has been leached from the surface soil and the upper part of the subsoil and is concentrated in the lower part of the subsoil. The Dawes soils occur in basinlike depressions and valleylike areas of the upland and on the higher parts of the level and less eroded tablelands. The soil materials differ in origin. In certain areas on the level, slightly eroded high plains the soils have doubtless developed from the deep weathering of the more calcareous and less gravelly parts of the bedrock, whereas soils in some of the lower lying areas represent weathered colluvial materials. Drainage channels are either absent or are poorly developed. Dawes silt loam is mapped in Garden County.

The Cheyenne soils have developed on alluvial deposits which have partly filled the stream valleys and draws in the western part of the Great Plains region. Here the topsoils are brown, and the subsoils are lighter brown or yellow. The substrata consist of porous sand and gravel. The subsoils are rather calcareous, and in places the surface soils contain some lime. The surface layer in many places contains much small gravel, and the subsoil is gravelly, coarse, and porous. In this county, Cheyenne gravelly sandy loam and Cheyenne fine sandy loam have been mapped.

The topsoils of the Tripp soils vary from brown to light gray; in many places they appear dark ash gray at the surface. The subsoils vary from light gray to white. Both topsoil and subsoil contain a high percentage of lime. The substrata consist largely of gray, stratified, highly calcareous fine sand and silt which contain a comparatively small proportion of coarse sand and fine gravel. Most of these soils are of alluvial origin and have developed on terraces or bench lands along streams above overflow. In places the soil has received some wind-laid material subsequent to its deposition or has been modified by colluvial sediments. Tripp fine sandy loam, Tripp very fine sandy loam, and Tripp silt loam have been mapped in this county.

The Bridgeport soils have brown or grayish-brown topsoils and lighter colored subsoils, though in many places there is no change in color to a depth of 3 feet. The lower part of the subsoils is calcareous in many places. The Bridgeport soils differ from the Valentine in their higher lime content and from the Tripp in the absence of the white, floury, calcareous layer in the lower part of the subsoil. The materials giving rise to these soils consisted of alluvium carried down from the adjoining uplands by intermittent streams and mixed with sediments brought down from higher lands to the west. Wind has also played an important part in the formation of these soils. The surface relief ranges from gently undulating to rolling. In this county Bridgeport fine sandy loam, Bridgeport very fine sandy loam, and Bridgeport silt loam, with a basin phase, have been mapped.

The Yale soils vary from gray to grayish brown. The upper part of the subsoil consists of a layer of light-brown compact loam which ranges in thickness from 15 to 18 inches, and the lower part consists of a layer of light yellowish-brown floury silt loam material. The topsoils are neutral or slightly calcareous, but the subsoils contain a high percentage of lime. These soils comprise low second-bottom lands which lie above overflow. The Yale soils differ from the Tripp only in the compactness of the upper part of the subsoil. Yale very fine sandy loam and the basin phase of Yale silt loam have been mapped in Garden County.

The topsoils of the Laurel soils vary from light gray to light grayish brown. The subsoils vary from light gray to brown and are highly calcareous. In places the lower part of the subsoil is almost white. The Laurel soils are alluvial, having developed on both the low and high terraces of North Platte River and some of its tributaries. They consist of sediments brought down from higher regions to the west and in places have received subsequent admixtures of

wind-laid material. The Laurel series is represented in this county by Laurel very fine sandy loam and Laurel silt loam.

The Sarpy soils consist of alluvium which has been brought down by North Platte River and by Blue and Rush Creeks. They are brownish gray or dark gray in color in the surface layer and have yellowish-gray or gray porous subsoils. Sarpy very fine sandy loam and Sarpy silt loam have been mapped in Garden County.

Areas mapped as dune sand include grass-covered sand hills and ridges which are composed almost entirely of gray sand. This land, on account of the tendency of the soil to drift when the vegetation is removed, is not suited to farming. Other miscellaneous soil materials have been mapped as river wash and rough broken land.

In the following pages of this report the various types of soils mapped in Garden County are described in detail and discussed in their relation to agriculture; their distribution is shown on the accompanying soil map, and their extent is shown in the following table:

Acreage and proportionate extent of the soils mapped in Garden County, Nebr.

Type of soil	Acres	Per cent	Type of soil	Acres	Per cent
Rosebud silt loam	32,448	5.8	Canyon loam	2,176	0.2
Deep phase	28,480		Dawes silt loam	7,744	.7
Rolling phase	1,664		Cheyenne gravelly sandy loam	2,432	.2
Rosebud loam	8,000	.9	Cheyenne fine sandy loam	4,672	.4
Deep phase	1,536		Tripp fine sandy loam	832	.1
Rosebud very fine sandy loam, deep phase	8,640	.8	Tripp very fine sandy loam	2,048	.2
Rosebud fine sandy loam	27,648	2.6	Tripp silt loam	2,816	.3
Rosebud gravelly sandy loam	11,200	1.0	Bridgeport fine sandy loam	25,344	2.3
Keith silt loam	7,232	.7	Bridgeport very fine sandy loam	6,784	.6
Colby very fine sandy loam	3,840	.9	Bridgeport silt loam	1,664	.5
Broken phase	5,632		Basin phase	3,392	
Colby silt loam	13,440	1.2	Yale very fine sandy loam	1,728	.2
Valentine fine sandy loam	18,112	1.7	Yale silt loam, basin phase	4,096	.4
Valentine very fine sandy loam	12,928	1.2	Laurel very fine sandy loam	6,720	.6
Valentine loamy fine sand	48,128	4.5	Laurel silt loam	5,824	.5
Valentine loamy sand	63,296	5.9	Sarpy very fine sandy loam	5,568	.5
Valentine sand	74,432	6.9	Sarpy silt loam	1,536	.1
Gannett loamy sand	9,536	.9	Dune sand	560,448	51.9
Gannett fine sandy loam	3,584	.3	River wash	2,432	.2
Scott silty clay	896	.1	Rough broken land	31,104	2.9
Canyon loamy fine sand	7,808	.7	Total	1,079,680	
Canyon gravelly sandy loam	11,840	1.1			

ROSEBUD SILT LOAM

The surface 3-inch or 4-inch layer of Rosebud silt loam consists of mellow dark grayish-brown loam. Below this is a layer of rather compact brown or grayish-brown, friable silt loam, which continues to an average depth of about 10 inches. In places the surface layer is underlain by a thin layer of sticky, darker brown material which consists of either heavy silt loam or light silty clay loam. The transition from the subsurface layer to the subsoil is abrupt. The subsoil may consist of yellow, grayish-yellow, or almost white floury silt loam material or of nearly pure silt which originated from the underlying Ogallala formation and which continues beyond a depth of 3 feet. The upper part of the subsoil in many places is slightly compact, but it is easily reduced to a friable condition. The topsoil contains a

moderate quantity of lime, the subsoil is calcareous, and the white material which forms the lower part is composed largely of lime carbonate. In many places fragments of limestone or calcareous sandstone are present in the lower part of the subsoil, and the land surface is strewn with fine gravelstones which include fragments of pinkish feldspar, granite, and other rocks. The presence of this material does not affect the texture of the soil.

Rosebud silt loam varies considerably. There are no large areas of uniform-textured soil. Mapped areas include patches of Rosebud loam and of other soils which have the characteristics of Dawes loam and Dawes silt loam. In the more rolling areas the partly weathered parent material crops out in places, appearing as white spots on the hillsides.

Most of this soil has developed on the almost level plains, though in places the surface is gently undulating. The most rolling areas are around the heads of streams. The flatter areas comprise most of the south table-lands, and a few scattered areas are on the uplands north of North Platte Valley. In the zone lying between the loess deposits, Rosebud silt loam is almost entirely free from surface gravel. Owing to its close association with these loess deposits a large percentage of the loess has been incorporated with it, with the result that it closely resembles the soils which have developed over that formation.

The general direction of the drainage is southeast. Even in the almost flat areas, the slope is sufficient to afford run-off for the surface water, and the porous subsoil and substratum insure ample underdrainage.

Rosebud silt loam is one of the most important agricultural soils of the county on account of its large extent and its natural crop adaptations. About 40 per cent of it is under cultivation and the rest is used for pasture and hay land.

Among the native grasses, buffalo and grama are dominant, and western wheatgrass, wire grass, and blackroot, are of secondary importance. Buffalo grass grows during early spring and then ripens. Grama grass and western wheatgrass succeed buffalo grass in the growing period, and their taller vegetative growths tend to shade the shorter grasses. Where the white subsoil comes near the surface, there is a scant growth of Stipa during the early part of the season and a sparse growth of western wheatgrass, which becomes more luxuriant as the depth of the surface soil increases. In places where the land has been severely grazed, heavy growths of wire grass may be found. Most of the weeds and wild flowers flourish early in the growing season, as the moisture is then plentiful. This behavior of native vegetation would indicate the advisability of growing early-maturing grain and other crops.

The most important cultivated crops are wheat, corn, and oats. Wheat is the principal crop on the heavier upland soils. Both spring and winter varieties are grown, but winter wheat is more popular. Turkey is the favorite variety, and Kanred is increasing in favor with some farmers. Corn is of secondary importance. Only the early-maturing varieties are planted. These are chiefly the dent varieties, although some blue corn and squaw corn (flour varieties) are grown. Oats are grown to supply feed on the farms and ranches;

the principal varieties are Swedish Select and Kherson. Alfalfa is gaining favor as a forage crop and has produced favorable yields, but its total acreage is very small. The crop does especially well on this soil, as the white material of the subsoil is rich in lime, and the water-retaining power of the soil is good. Some potatoes are produced for home consumption and for sale on the local markets. Some of this soil is included in livestock farms and ranches on which beef cattle, principally grade Hereford and Shorthorn, are grazed. Dairying is not practiced commercially, though a few milk cows are kept on many farms, and some farmers have a surplus of dairy products for sale. One square mile of land supports from 40 to 60 head of cattle the year around.

Wheat yields from 10 to 40 bushels to the acre depending on the rainfall and farming methods. Under good summer-tillage methods, it is believed by many farmers that high yields may be obtained. Corn yields from 10 to 30 bushels to the acre. When it is cut for fodder, from 1 to 3 tons are obtained. In average years oats yield 30 bushels to the acre; potatoes 100 bushels; and alfalfa is said to produce an average of 2 tons of hay from two cuttings.

No definite crop rotation is practiced, as the soil has not become impoverished by cropping. Wheat frequently succeeds wheat. Some farmers plan to rotate alfalfa with corn and wheat. New land is generally broken to a depth of 3 or 4 inches, often by means of heavy moldboard plows drawn by tractors. Old land is plowed every second or third year. Small grains are customarily sown with a drill or disked in on corn or stubble ground, though some winter wheat is seeded between the corn rows. Corn is usually listed, as the moisture conditions are better than when it is planted in checkrows on a level surface. A small acreage of the crop is planted on newly broken sod land.

The current value of Rosebud silt loam ranges from $60 to $90 an acre, depending on improvements and location.

Rosebud silt loam is naturally a fertile soil, and good crop yields are obtained where careful conservation of soil moisture is practiced. Frequent cultivation is necessary to keep the surface soil well loosened for corn and other tilled crops, but no attempt should be made to maintain a fine dust mulch which puddles during rains and is subject to removal by wind. A thorough preparation of the seed bed is advisable even though such preparation may result in a smaller cultivated acreage.

Rosebud silt loam, deep phase.—The deep phase of Rosebud silt loam occurs on the flat table-land in all parts of the county. In texture, structure, color, and drainage, this soil is similar to typical Rosebud silt loam. It differs from typical in the thickness of the upper layer of the subsoil. The loose ash-gray silt of the lower part of the subsoil is seldom present above a depth of 30 inches. This deep soil is preferred to typical Rosebud silt loam, on account of its flat surface, supposedly greater drought-resisting qualities, and larger crop yields in favorable years. Its selling price ranges from $10 to $15 an acre higher than that of the typical soil.

Rosebud silt loam, rolling phase.—The rolling phase of Rosebud silt loam occurs only on areas between tributaries of North Platte River. It is similar to Rosebud silt loam but, owing to the uneven-

ness of its surface, it is designated as a rolling phase of the typical soil. It is less desirable than typical Rosebud silt loam, and all of it is in pasture land.

ROSEBUD LOAM

Rosebud loam to a depth of 2 or 3 inches is dark grayish-brown mellow loam. Below this is rather compact brown or grayish-brown friable loam. This is underlain, at a depth ranging from 8 to 15 inches, by dark grayish-brown or grayish-brown friable loam or fine sandy loam usually somewhat heavier in texture than the surface soil. At a depth varying from 18 to 25 inches, this grades rather abruptly to gray, sandy and silty material. Small rounded feldspathic and quartzitic gravelstones, such as commonly occur in other members of this series, are present in the subsoil, and the surface is generally strewn with varying quantities of similar pebbles. The lower part of the subsoil is highly calcareous, but very little of the surface soil reacts with acid. The intermediate sandier layers have a moderate lime content.

The depth of the soil varies over the county. In places the heavier upper subsoil layer is lacking, and there is a rather abrupt transition from the dark grayish-brown topsoil to the lighter colored, highly calcareous subsoil. In many areas the topsoil and subsoil contain considerable coarse sand and waterworn gravel, together with limestone fragments and lime concretions. Gravel may be present in such quantity as to form patches of gravelly loam or sandy loam. In such areas the lower part of the subsoil lies near the surface or is exposed, as on hillsides, small knobs, or slopes to drainage ways, and the surface color is gray or white. Disregarding minor local variations, however, Rosebud loam retains its essential features over extensive areas.

Rosebud loam is widely distributed over the county, but its total area is small. The more extensive areas occur around the heads of drainage ways where erosion has removed the finer silty particles.

This land varies from level to rolling and hilly. Some areas comprise a part of the smooth, gently undulating uplands, but most areas are rolling and hilly and include eroded slopes along drainage ways.

This soil is well drained, and in places, owing to the porosity of the subsoil and substratum, drainage is excessive. Much of this soil is drained by intermittent streams which flow in a southeasterly direction, but where channels are not established the land in most places is sufficiently sloping to drain all surplus water rapidly.

About 10 per cent of this land is under cultivation, and the remainder is used for pasture and for the production of hay. The native vegetation consists of buffalo grass, grama grass, wire grass, and western wheatgrass in the more level areas. Wire grass is markedly conspicuous in the areas devoted to pasture, particularly in those localities where the surface is strewn with gravel. The relative abundance of this grass may aid in distinguishing Rosebud loam from other members of the Rosebud series. From 8 to 10 acres are required to pasture a cow or steer throughout the year.

Of the cultivated crops, wheat is the principal cash crop and has the largest acreage. Winter wheat is planted more extensively, Turkey being the principal variety. Under dry-farming conditions,

the crop yields average between 10 and 12 bushels to the acre over a series of years, but higher yields may be obtained by summer-tillage methods. Corn, oats, and rye rank in acreage in the order named. Corn yields from 10 to 25 bushels to the acre, but the average yield is between 12 and 15 bushels. In many seasons the crop fails to mature properly. Rye yields from 12 to 15 bushels to the acre and oats from 10 to 35 bushels. Oats are sometimes injured by warm, dry winds or drought. The crops are fed to work animals and cattle. Only the earliest-maturing varieties are grown, on account of the shortness of the growing season. Other crops include alfalfa, barley, and potatoes. Most of the potatoes are consumed on the farms where they are produced. A little alfalfa is grown, but the crop does not thrive on this soil. Kafir, millet, and sorghum are planted on a few farms for winter feed and furnish considerable forage. The yields of all crops show wide variations from year to year, since the amount of rainfall is the controlling factor.

The sod land is customarily broken to a depth of 3 or 4 inches. As soon after plowing as possible fields are disked and harrowed to prevent excessive loss of soil moisture. A slightly rough or lumpy condition is maintained to prevent drifting. The soil is mellow and easily managed under proper moisture conditions, but during periods of prolonged drought it becomes more compact and plowing and the preparation of a good seed bed become more difficult. Old land is plowed only every two or three years but is well disked each year before it is planted to grain. Most of the corn is listed, though some is surface planted. Small grain is planted with a press drill. Wheat and sorghum thrive better on sod land than do corn or oats which are better adapted to old ground. Oats do better on land previously devoted to corn, whereas millet does best when it is seeded on land that has been plowed before drilling. The plowing is more effective in killing weeds. Tractors are in use on this land, and the plowing, disking, and seeding are sometimes done in one operation.

No commercial fertilizers are used, but barnyard manure, occasionally applied, aids greatly in maintaining the productiveness.

The current value of this land ranges from $50 to $65 an acre, depending on improvements and nearness to markets.

As with Rosebud silt loam, the conservation of soil moisture is a very important factor in farming this kind of land. The soil gives fair returns in most years, but good tillage methods should be employed for moisture conservation, and better seed beds should be prepared for small grains even at the expense of decreased cultivated acreage. Tilled crops require cultivation to maintain a loose mulch, and the rolling and hilly areas close to drainage channels should be protected from erosion.

Rosebud loam, deep phase.—The deep phase of Rosebud loam occurs on the uplands of the county, but the total area is small and the bodies are widely scattered. In color, structure, and texture the soil is very similar to typical Rosebud loam. The deep soil differs from typical in the depth of the topsoil and upper part of the subsoil. In few places is the characteristic white floury calcareous subsoil present above a depth of 30 inches. This soil is preferred to the typical soil on account of its flatter surface and greater moisture-holding capacity.

ROSEBUD VERY FINE SANDY LOAM, DEEP PHASE

The surface soil of Rosebud very fine sandy loam, deep phase, consists of dark grayish-brown very fine sandy loam. The soil is from 12 to 16 inches deep, the depth varying with the flatness of the surface. The upper part of the subsoil gradually becomes lighter in color and, at a depth varying from 27 to 30 inches, grades to the white floury highly calcareous material characteristic of the lower part of the subsoil of the Rosebud soils. In places the middle layer is slightly compact, but this development is not so far advanced as in the Dawes soils.

This soil occurs in scattered areas ranging in size from small patches to more than 2 square miles. The areas are largest and most numerous in the western half of the county and immediately north of North Platte River. Several small patches occur on the southern table-land along the edge of the breaks of Rush Creek and in other parts of the high table-land.

This soil occupies flat or basinlike areas where weathering and leaching have extended to a greater depth than on the more rolling parts of the upland.

The deep phases of the Rosebud soils are generally considered more retentive of moisture than the typical soils, and the selling price is slightly higher.

ROSEBUD FINE SANDY LOAM

The surface soil of Rosebud fine sandy loam varies from grayish-brown to dark grayish-brown fine sandy loam, averaging about 12 inches deep. It is friable and contains a high percentage of fine and very fine sand, but the presence of a small quantity of finely divided clay gives the soil sufficient adhesiveness to retard removal by the wind. This loamy sticky quality is characteristic, but it does not make the surface material compact. The next layer is of lighter colored fine sandy loam, which in places is slightly more compact than the surface soil. Below a depth varying from 24 to 27 inches, the material is coarser, more friable, grayish in color, and calcareous and otherwise assumes the characteristics of the corresponding material of the Rosebud soils. The upper part of the subsoil, owing to its porosity, is in most places leached of lime, but the lower part effervesces freely with acid.

This soil varies somewhat over the county. In places fragments of the Ogallala bedrock are present at a depth of 3 feet. In many places on the slopes, the loose sand has been washed or blown away, leaving exposed the white calcareous material. The parent material consists of sandstone of late Tertiary age, and the high sand content of the soil is probably largely attributable to the removal of the finer particles in the process of weathering and to the addition of drifting sand.

Rosebud fine sandy loam occurs in scattered areas on both the north and south uplands. The areas are irregular in shape and are associated with other members of the Rosebud series or with sand-hill areas. The surface is characterized by slopes, moderately rolling hills, and low ridges. Drainage is everywhere thorough and

in a few places is excessive, owing to the porosity of the topsoil and subsoil.

This soil is rather extensive, but very little of it is under cultivation. It is used mainly for grazing cattle. The native grass vegetation consists of wire grass, buffalo grass, redfieldia, sand reed grass, and Stipa. The soil is not well adapted to wheat and alfalfa. Corn yields from 15 to 25 bushels, wheat 10 or 12 bushels, and rye, which is a rather sure crop, from 12 to 15 bushels to the acre. The forage crops yield a fair tonnage.

The soil is friable and easy to till. Cultural methods should be such as to protect the small grain from injury. The application of manure would tend to prevent wind erosion.

The current selling price of Rosebud fine sandy loam ranges from $15 to $30 an acre, depending on improvements. In small areas included with Rosebud fine sandy loam in mapping the surface soil is of greater depth and coherency, and the loose, sandy subsoil is not present above a depth of 20 or 30 inches. The depth to the subsoil causes a more favorable structure and increases the water-holding capacity of this soil.

A very fine sandy loam variation of this soil occurs on the northern upland, mainly about the heads of drainage ways. It does not differ materially from the typical fine sandy loam except in the larger proportion of very fine sand in the surface soil. The color of the soil is dark grayish brown, and the depth ranges from 8 to 12 inches. The upper part of the subsoil and the material just above a depth of 3 feet are very similar to the corresponding layers in the typical fine sandy loam.

ROSEBUD GRAVELLY SANDY LOAM

The surface soil of Rosebud gravelly sandy loam consists of grayish-brown or dark grayish-brown loose gravelly sandy loam including patches of gravel, gravelly sand, and gravelly loam. There is very little textural difference between the topsoil and the subsoil, though the latter becomes yellowish and lighter in color with depth and in many places is slightly calcareous. The materials vary widely. The sand carries from fine to coarse, and the gravel from small waterworn pebbles to stones 3 or 4 inches in diameter. The granites are most abundant.

This soil occurs principally north of North Platte River, adjacent to most of its tributary valleys, and in the drainage ways which penetrate the loess in the eastern part of the county. It occupies the gravel-covered hills and ridges on the slopes from the uplands to the terraces, and occurs around the heads of streams and along the valley walls. Typical areas are north of Lisco and bordering Blue Creek and other drainage ways. Patches are mapped along all the tributaries which empty into these streams. The soil covers what appears to be remnants of an old high terrace which was formed when the major streams were flowing at much higher levels than at present. The presence of this soil along Blue Creek, Walrath Draw in Deuel County to the south, and in the sand hills in the north-central part of Garden County is not fully understood. The former position of these channels appears to have been marked by shallow deposits of sand, gravel, and waterworn bowlders which capped the tops of the

hills and ridges at a common level. The soil materials which constituted those parts of the land which were not protected by gravel deposits have been eroded, and the protected areas remain as ridges and hills.

It is apparent that this soil is not a true member of the Rosebud series. The porosity of the parent material has prevented the development of the dark color of the soil and the accumulation of lime in the subsoil. The source and age of the parent material is also a subject of dispute among geologists. As the soil is associated with the Rosebud soils and as it has some of their characteristics, it was included in the Rosebud series.

This soil has very little agricultural value. It is porous and not retentive of moisture. The character of the land surface is not favorable for farming, except on the patches of this soil which are included in mapped areas of other soils where the deposits of gravel are thin. Some grasses have obtained a foothold, affording fair pasturage, but a greater acreage to the head is required for grazing cattle than on the heavier soils. Areas of this soil furnish sand and gravel for local building and road purposes.

The selling price of Rosebud gravelly sandy loam ranges from $12.50 to $17.50 an acre. Most of it is sold in conjunction with adjacent soils and it tends to reduce the value of the farms on which it occurs.

KEITH SILT LOAM

The surface soil of Keith silt loam consists of dark grayish-brown mellow silt loam, 10 or 12 inches deep. This is underlain by friable, moderately compact material which varies from brown to grayish brown in color and from silt loam to silty clay loam in texture. Below a depth varying from 24 to 30 inches, the material is ash-gray or pale yellowish-gray silt or silt loam. The material of the lower part of the subsoil is generally lighter in texture than that above and continues to a depth greater than 3 feet. The substratum consists of a very thick layer of light yellowish-gray or buff-colored loess, speckled with white particles of carbonate of lime. The surface soil has a high content of organic matter. It shows no reaction when treated with dilute hydrochloric acid, but the lower part of the subsoil is highly calcareous.

Keith silt loam is remarkably uniform in texture and color over large areas. On ridges and slopes the soil may be lighter in color than typical, and in the smaller basinlike depressions it is very dark and appears much heavier than it really is. Owing to its close association with Colby silt loam, to which it grades, small patches of the Colby soil are included in mapped areas of Keith silt loam.

Keith silt loam occurs in small areas on the high loess ridge on the south table-land and in more extensive areas on the western margin of the high table-lands which extend eastward into Keith County. A few patches are mapped on the north side of North Platte River, north of Lewellen. This soil occupies smooth ridges and hills with gentle slopes and small pockets on the ridges.

Drainage is adequate except in the basin areas where it is partly obstructed by lack of drainage outlets. In such areas much of the water gathers in the lower parts, and some escapes by percolation.

Not more than 40 per cent of this soil is under cultivation, but it is valuable agriculturally and could be more generally utilized for cultivated crops. The native vegetation consists of buffalo grass, grama grass, western wheatgrass, and the sedge blackroot. These cover the surface of the ground, forming a thick mat. Buffalo and grama are the predominating grasses. They furnish excellent hay and pasturage, especially on areas where moisture is sufficient to keep the buffalo grass green. Although Keith silt loam is hardly more than half as productive as the principal upland soils of eastern Nebraska which receive ample rainfall, its natural fertility is fully as great. During favorable seasons, when rainfall is adequate, crop yields are often more than double those procured in normal seasons. This soil is naturally treeless.

Winter wheat and corn are the principal crops, and barley, oats, and sorghum are minor crops. The soil is well adapted to general farming but is better suited to small grains and forage crops than to corn. Winter wheat, the most profitable crop, yields from 10 to 35 bushels to the acre, depending on the season; corn yields from 10 to 25 bushels, and occasionally more; barley from 10 to 35 bushels; oats from 15 to 40 bushels; and sorghum from 2 to 5 tons of fodder. Potatoes are grown for home use and do well under favorable conditions.

Beef and dairy cattle and hogs are raised. Hog raising has been somewhat curtailed because of the present low market prices. Dairy cattle are raised mainly for home use.

Wheat is drilled either in stubbled ground or old cornland. Land for corn is disked, and the seed is listed in. Both crops frequently succeed themselves. Farm tractors are coming into use and some of the major farming operations are performed by motor power. Sod land is broken, with tractors, to a depth of 3 or 4 inches. Owing to its smooth surface, friability, and siltiness, this soil is easily managed under a wide range of moisture conditions. Little barnyard manure is used, and the cultural methods are practically the same as those used on other heavy upland soils.

This land is currently valued at prices ranging from $60 to $100 an acre, depending on the improvements.

Keith silt loam is one of the best soils in the county. It contains sufficient organic matter and fine material to prevent excessive blowing. If it is cultivated when in the proper moisture condition it may clod to some extent, but the clods readily crumble under proper cultural methods. Although Keith silt loam shows no signs of a reduced productivity, some provision should be made to maintain productiveness.

COLBY VERY FINE SANDY LOAM

In Garden County, Colby very fine sandy loam differs from Colby silt loam only in the texture of the surface soil. The material is grayish-brown or light grayish-brown calcareous very fine sandy loam which is loose and friable and continues to a depth of 10 or 12 inches. It contains considerable fine sand in places, but elsewhere approaches loam in texture. The subsoil is gray or grayish-brown silty very fine sand or silt loam which grades to the loose floury loess materials. Both topsoil and subsoil have a smooth feel, are cal-

careous, and contain little organic matter. The color and depth of the surface material vary considerably with the topographic position of the soil, and the texture in places approaches loam or silt loam. On the more level areas and on gradual slopes where conditions have favored the accumulation of organic matter the soil is very dark and deep and the lower part is loam or silt loam in texture.

This soil occurs in close association with Colby silt loam and probably consists of Colby silt loam, the surface material of which has been so intermingled with wind-blown sand that it has assumed a very fine sandy loam texture.

Surface features differ little from those of Colby silt loam. The land is, in general, moderately rolling. Drainage is everywhere good, the loose porous soil and subsoil absorbing rainfall rapidly.

This soil is important agriculturally but is not extensive. It is naturally strong and fertile, comparing favorably with Colby silt loam in crop production. It can be tilled under a wider range of moisture conditions.

About 40 per cent of this soil is under cultivation, and the remainder is used for pasture and for the production of hay. The pasture grasses include redfieldia, western wheatgrass, big bluestem, and little bluestem or bunch grass. Hay yields from one-fourth to three-fourths ton to the acre in favorable years.

Wheat, corn, sorghum, and rye constitute the principal crops. Wheat is the cash crop. Principally winter varieties are sown, and the yield ranges from 8 to 25 bushels to the acre, depending on the season. Corn yields from 15 to 25 bushels to the acre; sorghum from 1 to 2 tons of fodder; and rye from 12 to 20 bushels of grain. Most of the forage crops are consumed on the farm or are sold locally.

Tillage practices are similar to those used on the other upland soils. This soil is easily worked and forms a good mulch, but caution must be exercised to prevent blowing.

The current value of this land is from $25 to $60 an acre, depending on improvements and distance from markets.

Colby very fine sandy loam, broken phase.—Areas of badly eroded stream slopes and bluffs in the central and eastern parts of the county are mapped as Colby very fine sandy loam, broken phase. The broken soil consists of grayish-brown silty very fine sand which is underlain, at a depth varying from 4 to 7 inches, by pale-yellow or light grayish-yellow silty very fine sand which grades, within a short distance, to the unweathered, loose floury loess material. Both topsoil and subsoil are highly calcareous. A high content of lime carbonate and organic matter tend to bind the soil and check erosion to a marked extent.

Areas of this soil are rough and hilly, with numerous steep slopes and precipitous bluffs. All parts of the soil are dissected by intermittent streams which have cut deep, abrupt, almost perpendicular walled valleys into the originally level upland surface. Landslides are common, and the slopes in many places present a succession of steps, known as catsteps, the result of these slides. Owing to the steepness of the slopes, drainage over most of this soil is excessive, the only exception being the included stream valleys and several small areas that have escaped excessive erosion. The land is unsuited for cultivation and is used almost exclusively for grazing and hay production.

Where erosion has been severe, the slopes are almost barren of vegetation or support a sparse growth of pasture grasses, weeds, and shrubs. Much of the area, however, supports good stands of nutritious grasses, including little bluestem or bunch grass, buffalo grass, wire grass, June grass, the sedge blackroot, and grama grass. There are no trees. The narrow, secluded bottoms of some of the numerous ravines and small hollows support an abundant growth of June grass which is cut for hay.

Colby very fine sandy loam, broken phase, is devoted exclusively to pasture. In connection with the adjacent areas of level land it is peculiarly adapted to stock raising, as the canyons insure protection for cattle during the winter and furnish pasturage during the greater part of the year. When the animals are winter fed, from 7 to 10 acres will support one steer, but from 12 to 20 acres are required for pasturage throughout the year. Grade Hereford and Shorthorn are the principal breeds of beef cattle. The animals are shipped as stockers and feeders.

The current value of this land ranges from $10 to $25 an acre, but very little is sold except with adjoining level areas.

Overgrazing and fires are the two outstanding dangers to be guarded against in the efficient use of this soil.

COLBY SILT LOAM

The topsoil of Colby silt loam is brown or light grayish-brown calcareous silt loam, 10 or 12 inches deep. The upper part of the subsoil has a similar or slightly lighter color and is similar in texture and structure. It has the characteristic smooth, floury feel of the loess material from which it has developed. It grades to the lower part of the subsoil, which consists of the very light colored, unweathered parent loess.

There are few variations from the typical soil. On the smoother and less eroded areas the surface layer continues to a greater depth than on those positions where erosion has removed the organic matter accumulations. In the latter situations, the white material of the subsoil lies close to the surface.

Colby silt loam occurs in the southeastern part of the county as a long, narrow ridge varying from 1½ to 2 miles in width and lies adjacent to the eastern boundary of the county on both the north and south sides of North Platte River, forming the western margin of a body of loess which extends into Keith County on the east.

Areas of this soil are gently sloping or undulating and along the drainage ways are rolling. Drainage is adequate or thorough, owing to the open structure and sloping position of this land. The subsoil retains moisture remarkably well and this feature, during seasons of low rainfall, results in yields higher than those obtained on the heavier Keith silt loam.

Some crops are grown on this soil, but the larger part of it is in hay and pasture. Grama and buffalo grass predominate among the native grasses and cover the surface of the ground with a thick mat. There are scattered areas of big bluestem and wire grass. Along the drainage ways where erosion has been sufficiently severe to produce the catstep formations, there are patches of bunch grass. Western wheatgrass flourishes in the more moist areas and along the

margins which approach Keith silt loam. Broomweed and cerelia (*Gutierrezia sarothae*) are weeds commonly found in pastures. From 6 to 8 acres are considered sufficient to support one horse or cow when supplementary feed is given during the winter months.

Not more than 25 per cent of this soil is under cultivation. Wheat and corn are the principal crops, and sorghum is of secondary importance. Over a number of years, under dry-farming methods, wheat averages between 10 and 12 bushels to the acre, though much higher yields are obtained in favorable years. Corn ranks close to wheat in acreage, and yields average between 12 and 15 bushels to the acre. Sorghum produces good yields of forage, usually from 1 to 3 tons to the acre. Oats, kafir, and barley are crops of minor importance.

Owing to its friability and siltiness, this soil is very easily worked, can be handled under a wide range of moisture conditions, and retains moisture well. Where the field is disked before listing for corn, it withstands drought well. Now and then fields are plowed, but this practice aids drifting when the soil is thoroughly broken. No commercial fertilizer is used, but manure is applied by the more progressive farmers.

The current value of Colby silt loam ranges from $60 to $90 an acre, depending on improvements and surface features. The badly eroded areas have a comparatively lower value but are always sold in conjunction with areas of more tillable farm land.

The content of organic matter is naturally low, and the soil shows some tendency to wash. Cultural methods designed to remedy these conditions should be adopted. Overgrazing the pastures should be guarded against.

VALENTINE FINE SANDY LOAM

The surface soil of Valentine fine sandy loam consists of dark grayish-brown or grayish-brown fine sandy loam fairly rich in organic matter. It contains a comparatively large proportion of very fine sand and sufficient clay and silt to prevent excessive wind erosion under normal agricultural conditions. At a depth of 15 or 18 inches, the color becomes slightly lighter and the soil material sticky in character. This condition is maintained throughout the soil, the lower layers becoming lighter in color. Valentine fine sandy loam differs from Rosebud fine sandy loam chiefly in the low lime content of its subsoil.

Over its entire area this soil is fairly uniform. The bodies are irregular in outline and some mapped areas, especially the larger, include patches of other soils. In places, especially in the lower positions where the land is nearly flat, the dark color exists throughout the entire soil.

Most of this soil occurs in the valleys and basinlike depressions of the rolling uplands on the north side of North Platte River, but a few areas are mapped on the south table-lands.

Most of the Valentine fine sandy loam is associated with sand dunes, and some of the soil material has been derived from that source by wind deposition. It is probable that this soil consists of material weathered from the sandy strata of the Tertiary formation, to which wind-blown sand has been added.

Valentine fine sandy loam is well but not excessively drained. The surface features are exceedingly favorable for the accumulation and retention of moisture, a condition which has favored the development of a sticky, less pervious subsoil. Owing to the porosity of the topsoil and subsoil, practically all the rainfall is immediately absorbed. The position of this soil favors the accumulation of more organic matter than is possible in the sandier members of the series.

Valentine fine sandy loam is important agriculturally, especially in the sand-hill region where it is well adapted to corn production. Only a small percentage, on account of the danger of drifting when improperly handled, is under cultivation. Much of the soil is included in stock farms on which cattle raising is an important industry. The native vegetation consists of grama grass, buffalo grass, needle grass, sand grass, and a scattered growth of bunch grass. These grasses produce from one-fourth to three-fourths ton of hay to the acre and support from 30 to 40 head of cattle to the square mile throughout the year.

The principal crops are corn, wheat, rye, and sorghum. Corn is very profitable, though yields vary widely from year to year, ranging from 15 to 30 or more bushels, depending on the season. Wheat, the cash crop, produces from 10 to 20 bushels to the acre, occasionally more, and rye yields from 12 to 20 bushels. Sorghum yields from 1 to 2 tons of forage. Small fields of beans, emmer, and flax are grown. Potatoes and oats do well but are grown mainly for home consumption. Wheat and rye are planted between corn rows.

Valentine fine sandy loam is less subject to drifting than are the sandier members of the series, but caution should be exercised and the crop should be cultivated only sufficiently to kill the weeds.

The current selling price of this land ranges from $15 to $30 an acre, depending on improvements and the percentage of sandier soils included.

VALENTINE VERY FINE SANDY LOAM

Valentine very fine sandy loam, to a depth of 10 or 12 inches, is brown or dark grayish-brown friable very fine sandy loam. The surface layer is generally darker than the lower layers, owing to a slightly higher content of organic matter. In places where conditions have favored the growth and decay of vegetable matter, the surface material is almost black. The subsoil is lighter in color than the surface soil, typically has a higher content of silt and clay, and is slightly sticky and compact. At a depth of about 30 inches, the subsoil grades to light-brown or gray fine sand or very fine sand, loose and incoherent in structure. Neither topsoil nor subsoil is calcareous. The material probably consists of weathered Tertiary sand, together with wind-blown and water-washed particles from the adjoining or neighboring sand hills. It has been subjected to more thorough weathering than the other members of the series.

This soil is fairly extensive, occurring in areas of different size on the north and south uplands of the county. The largest areas are north of North Platte River. One of the most extensive and typical areas is 4 miles northeast of Lisco.

Areas of this soil vary from flat to gently undulating, the surface being relieved by low hummocks and basins resulting from wind

action. In general, the surface is almost flat, and surface drainage is not well established. The porous subsoil, however, absorbs the light rainfall and water seldom stands on the surface except immediately following heavy rains.

About 60 per cent of this soil is under cultivation, and the remainder is used for pasture and hay land. The native vegetation consists of western wheatgrass, redfieldia, Stipa, and some buffalo and grama grasses. Native hay yields from one-fourth to three-fourths ton to the acre, depending on the rainfall. One square mile will support from 30 to 40 head of cattle the year around.

The most important crops are corn, wheat, oats, and potatoes. Wheat is the cash crop; corn and oats are fed on the farms; and potatoes are grown for home consumption. Small acreages of alfalfa are grown. The soil is very productive, owing to its high natural fertility and the character of its subsoil which allows the accumulation and retention of available moisture. Corn yields vary in different seasons from 10 to 30 bushels to the acre; wheat produces from 8 to 20 bushels and potatoes from 75 to 150 bushels.

This soil is less subject to drifting than any of the Valentine soils but is cultivated only enough to keep down the weeds and maintain a surface mulch. Care is necessary to grow small grains successfully as the soil is subject to wind erosion.

The current value of Valentine very fine sandy loam ranges from $15 to $45 an acre, depending on improvements, nearness to towns, and other conditions.

Some small areas of Valentine loam are included wth this soil as mapped. In such areas the soil, to a depth varying from 8 to 12 inches, is brown or dark-brown friable loam. This is underlain by an upper subsoil layer of brown loam or light silt loam which, at a depth varying from 24 to 30 inches, grades to light-brown or grayish-brown loam. This soil occurs in a few small flat depressions but it is impracticable to separate it in mapping. It has nearly the same agricultural value as Valentine very fine sandy loam, and on account of its small extent it is of little importance.

VALENTINE LOAMY FINE SAND

Valentine loamy fine sand, to a depth of 10 or 15 inches, is brown or grayish-brown loose friable loamy fine sand. The depth and color of the material vary with the topographic position. In the basin areas, where accumulation of organic matter is favored, the soil is deeper, darker, and more coherent. The subsoil is loose, incoherent, grayish-brown fine sand or sand which with depth grades to lighter textured grayish-brown sand resembling dunesand. Both topsoil and subsoil are poor in organic matter and deficient in lime. The lack of the characteristic sticky layer serves to distinguish this soil from Valentine fine sandy loam. Valentine loamy fine sand occurs throughout the county, except on the hard table-lands. Nearly everywhere it is associated with sand dunes from which some of the soil material has been derived. Areas of the soil are gently undulating and in many places are broken by small ridges and knolls. Surface drainage is not established, but the rainfall sinks into the porous sand and is carried away through underground channels.

Some of this soil can be successfully farmed, but as a rule it is subject to drifting when broken and for this reason nearly all of it is used as pasture and hay land. Small areas are cropped to corn and potatoes, but the soil, owing to its open structure, does not retain so much moisture as Valentine fine sandy loam. The native vegetation consists of bunch grass, Stipa, grama, sand grass, and scattered clumps of sagebrush. Hay yields from one-fourth to three-fourths ton to the acre, depending on the rainfall. This land will pasture from 30 to 40 head of cattle to the section.

The current value of this land varies from $10 to $15 an acre. In places Valentine loamy fine sand can grow crops under careful management. It has been cropped to corn and potatoes in other parts of the West. The broken surface, however, should be kept as rough as possible to prevent drifting, and the supply of organic matter should be increased by the application of barnyard manure or like materials. Large areas in the sand hills should be kept in pasture.

VALENTINE LOAMY SAND

The topsoil of Valentine loamy sand varies from dark grayish-brown to grayish-brown loose loamy sand, from 12 to 15 inches deep. The subsoil is incoherent grayish-brown sand, resembling the subsoil of dune sand. On the low ridges and knolls where conditions have been unfavorable for the incorporation of organic matter, the soil is very loose and incoherent. In general, both topsoil and subsoil are deficient in organic matter and lime.

In some included areas on the rolling uplands in the northern part of the county, small waterworn gravel are present on the surface, in the topsoil, and in the subsoil. These areas are probably exposures of bedrock projecting above the wind-laid material. Valentine loamy sand occurs chiefly in the northern part of the county and is associated with dune sand. The areas are irregular in shape, and many are several hundred acres in extent.

Areas of this soil occur on a gently rolling plain broken by small ridges and knolls. The slope is in a southeasterly direction. Underdrainage is good, the loose porous sands affording an ample inlet and outlet for all surplus water.

Valentine loamy sand has little agricultural value, as it is subject to drifting when cultivated. It is used as pasture and hay land.

The predominating vegetation is sand reed grass. Other grasses include Stipa and bunch grass and, in the lower areas, a sparse growth of buffalo grass and grama grass. The sand reed grass is the principal hay grass and yields from one-fourth to three-fourths ton to the acre, depending on the rainfall.

The current selling price of land of this kind ranges from $10 to $15 an acre, averaging about $12.

Valentine loamy sand is of better quality than dune sand. The surface layer is stained with organic matter, and in places the entire soil is dark in color. This soil occurs in a lower position than dune sand and is less subject to wind erosion. With extreme care small included areas may be cultivated to corn or rye, but provision should be made to leave the surface in as rough condition as possible to prevent blowing. For this reason, cattle should not be pastured in the cornfields.

VALENTINE SAND

Valentine sand consists of light grayish-brown or yellowish-brown loose, incoherent sand more than 3 feet deep. Because of its content of organic matter the surface layer, to a depth of 4 or 6 inches, is in most places somewhat darker than the lower part of the soil. However, the organic matter is not present in sufficient quantities to prevent the soil from drifting when the protective vegetation is destroyed. The sand of which this soil is so largely composed consists chiefly of medium and fine grades, with barely sufficient silt and clay to render the mass slightly coherent when wet. This soil contains very little lime. It differs from dune sand in having a smoother surface and in being stable in undisturbed areas. The sand grains are slightly more rounded than those of dune sand.

Valentine sand is remarkably uniform throughout the area of its occurrence in Garden County. There are local variations in the quantity of organic matter and in the proportion of the different grades of sand present, but these are of such minor importance as not to warrant separation on the soil map.

Valentine sand is very extensive in this county. It occurs chiefly in the northern part of the county, where it is the dominant soil on the sand flats and narrow, sinuous valleys throughout the sand hills. It is typically developed in the valley north of Eldred Ranch and south of Orlando. Large areas are northeast of Sandbeach Lake and north of Schoonover and Hills Lakes. It is the dominant soil in Dwire, Jerry, Putney, and Bennett Valleys.

The exact origin of Valentine sand is not clearly understood. It has probably been developed over wind-blown materials originally released from the disintegrated Tertiary rocks of western Nebraska. The material, however, has been so shifted by wind and water, redeposited and subsequently weathered, that it is not possible to make any positive statement in regard to its origin.

Areas of this soil are flat or gently undulating, and in places are broken by numerous small ridges and knolls which give the surface a choppy or hummocky appearance. Thorough drainage is provided by the loose porous sands. Valentine sand occurs in the drier and better drained localities in the sand-hill valleys, and the Gannett soils occur in the poorly drained positions.

Valentine sand is used almost exclusively for pasture and hay land. A few farmers plant corn on the lower areas, but the yields are low except in the most favorable seasons. This soil has an excellent growth of native grasses that support from 100 to 150 cattle to a section during the summer grazing season, or, when cut for hay, yield from one-fourth to one-third ton to the acre.

Valentine sand sells at prices ranging from $12 to $20 an acre, depending largely on improvements.

It is doubtful if the native covering of grasses should be broken on this soil as it is extremely difficult to prevent drifting when the land is under cultivation. Great care should be taken to keep a protective vegetative covering on the surface.

GANNETT LOAMY SAND

Gannett loamy sand, to a depth ranging from 8 to 12 inches, consists of dark-brown or very dark grayish-brown material composed of medium fine and very fine sand together with a large proportion of well-decayed organic matter. The color and structure of the soil vary with the organic-matter content. In the more poorly drained areas where plant growth and decay have been favored, the soil is almost black, is spongy, and is noticeably light in weight. In many of the drier localities the surface soil contains barely sufficient organic matter to give it a dark color and loamy texture. The subsoil is light grayish-brown or yellowish-brown loose incoherent sand which continues to a great depth. It contains little organic matter, as the color indicates. The surface soil is calcareous in a few places, but the subsoil, in some areas, contains sufficient lime to react with acid.

Gannett loamy sand occurs chiefly in the lower sand-hill valleys and depressions throughout the northern part of the county. Most of the areas occur as narrow strips around or bordering the margins of the numerous sand-hill lakes. Some of the largest and most typical areas are around East Hill, West Hill, Sandbeach, Ramsay, Reno, Hackberry, and Meyer Lakes.

Gannett loamy sand has weathered from the same parent materials that gave rise to the Valentine soils but has been modified more by the growth and decay of vegetation. The water table is near the surface, favoring a rank growth of coarse meadow grasses. Areas of the soil are flat, and drainage is poor.

On account of its poor drainage this soil is of little value for cultivated crops. It is all used for pasture and hay. The native grasses will support one cow or horse to the acre during the summer grazing season or, when cut for hay, yield about 1 ton to the acre. The hay is somewhat coarser and has a lower sale value than that obtained on the better drained soils of the county. Its greater yield, however, in a large measure offsets its inferior quality. All of the hay is fed on the farm where it is produced.

The selling price of Gannett loamy sand ranges from $15 to $20 an acre.

GANNETT FINE SANDY LOAM

The surface soil of Gannett fine sandy loam is dark grayish-brown or black fine sandy loam from 7 to 10 inches deep. It contains an abundance of organic matter. In many of the lower depressions, where conditions have been especially favorable for plant growth and decay, the soil is spongy and closely resembles muck. On the better drained areas, the content of organic matter is lower and the color of the soil is lighter. The subsoil varies from light grayish-brown incoherent medium sand to fine sand. It contains very little organic matter and lacks the porosity that characterizes the surface soil in places. The subsoil continues to a great depth, and the material below a depth of 4 feet is similar to that which occurs at a similar depth in dune sand. The transition in color and texture between the topsoil and subsoil is commonly very abrupt. The surface soil in many

places is faintly calcareous, but in only a few places is the lime in the subsoil sufficient to effervesce with acid.

Gannett fine sandy loam occurs in only a few small areas and narrow strips within the sand-hill valleys in the northwestern part of the county. Some of the most typical areas are around Sturgeon, Sand, Schoonover, Miles, and Calvin Lakes. The soil has weathered in much the same manner as Gannett loamy sand, but the process of weathering has evidently continued for a longer time, as the texture is somewhat finer and a larger quantity of organic matter has accumulated.

Areas of Gannett fine sandy loam are flat. The soil occurs on some of the lowest positions in the sand-hill region. Most of it borders the lakes. The water table is everywhere near the surface, and drainage is poor, small areas remaining marshy most of the year.

Gannett fine sandy loam is used exclusively for pasture and the production of hay. In average years the grasses on each acre will support a cow or horse during the summer grazing season, and when cut for hay the yield ranges from 1 to 1¼ tons to the acre. The hay is very coarse and is of lower value than that obtained from the better drained Valentine soils.

This soil has about the same sale value as has Gannett loamy sand.

The chief need of this soil is adequate drainage, but it is doubtful if the increased returns would warrant the expense involved. The hay could be greatly improved by adding tame grasses, such as timothy and clover, to the native vegetation.

SCOTT SILTY CLAY

Scott silty clay consists of a 10 or 12-inch layer of dark grayish-brown or dark-gray compact silty clay, underlain by gray or medium-gray, tough silty clay. Both the topsoil and upper part of the subsoil are sticky and plastic when wet and hard and brittle when dry. At a depth ranging from 24 to 30 inches, the subsoil becomes lighter in color but retains its original tenacity and compactness. Where the upper stratum is thick, the subsoil in many places shows no appreciable change in color or texture to a depth of 3 or more feet. The entire soil is so compact as to be almost impervious.

Scott silty clay is very uniform in texture, particularly in the large areas. The smaller areas, especially those in the loess region, have a silty clay loam surface soil, and where they occur near areas of sandy soils, sandy material may appear on the surface.

Scott silty clay occurs in sinklike depressions widely distributed over the uplands. The areas range in extent from 1 or 2 acres to 25 or 30 acres. Many are too small to be shown on the map. One of the largest areas is about 1 mile southeast of Prairie View School. The soil consists of sediments carried by sheet water from the surrounding higher areas into shallow depressions, locally termed "buffalo wallows," and, as these have no drainage outlet, the water escapes only by evaporation and percolation. These waters moving into the subsoil carry the finer particles in suspension and deposit them throughout the soil. After heavy rains water stands on the surface for periods of time ranging from a few days to a week or

two. Owing to the character and position of the soil, road construction over these areas is always difficult. The surface in most places presents a rough, corrugated appearance.

On account of its poor drainage, Scott silty clay is used mainly for pasture and hay land. Occasionally it is broken, in conjunction with neighboring areas, and planted to corn or wheat, but the crops either drown out or dry out, depending on the season. The native vegetation consists of large quantities of Carex, some gum weed, smartweed, and, in wet places, meadow marigold. Sparse growths of grama grass, buffalo grass, and western wheatgrass are cut for hay. Owing to the more favorable moisture conditions, the growth of vegetation is more luxuriant than on other upland soils. This soil is always sold in connection with adjoining soils which determine its value.

This soil could be cropped if adequate drainage were provided, but, in general, this is not practical. Special treatment is required as the material is too compact in its natural state. It may be possible to drain the soil by digging into the gravel beds under the surface, but it is questionable whether this would be profitable.

CANYON LOAMY FINE SAND

Canyon loamy fine sand consists of brown or grayish-brown loamy fine sand or fine sandy loam, from 8 to 10 inches deep, underlain at a slight depth by white calcareous bedrock which is nowhere more than 30 or 36 inches below the surface. Over the greater part of the soil, numerous outcrops of the bedrock give the soil a spotted appearance. This soil is similar to the Rosebud soils, but, in general, the white layer is absent. A sufficient time has not elapsed for its formation, and erosion has been so severe that the surface soil extends to the bedrock.

The areas of Canyon loamy fine sand are inextensive. They occur on the least eroded part of dissected land and are distributed about the upland plains. Many patches too small to be shown on the map are included with mapped areas of other soils. Drainage is, in most places, adequate or excessive. No crops are grown, and the soil is of little agricultural value, owing to its small extent and poor adaptation to crop growth. As pasture land from 12 to 15 acres are required to support one animal. The most common grasses are buffalo, grama, and wire grass, and there are patches of western wheatgrass. These grasses furnish fair pasturage, and the rough land surrounding affords protection for livestock during severe weather. Yucca grows on the more exposed areas.

On account of its position and because it is subject to erosion, the pastures on this land should not be overgrazed and the grass covering should not be destroyed.

CANYON GRAVELLY SANDY LOAM

Canyon gravelly sandy loam, to a depth ranging from 5 to 12 inches, consists of grayish-brown loamy sand containing a comparatively high percentage of angular limestone pebbles and fine gravel which impart to the soil a loose porous structure. The subsurface

layer consists of lighter colored sandy and silty materials of the Ogallala formation. The sands are of fine or coarse texture.

This soil includes areas of stony loam too small to separate on the map. The surface soil of these patches is of lighter color, the stone content is greater, and the slopes are steeper than on the typical soil. Rock outcrops are common, and the soil has a lower value than Canyon gravelly sandy loam. In other places, there is a comparatively large proportion of fine material consisting chiefly of the finer grades of sand together with some silt and clay.

Canyon gravelly sandy loam occurs exclusively on the rough lands bordering North Platte River and its tributaries. It is extensive along Rush Creek. Areas are rolling or hilly and, where the bedrock is exposed in bluffs, are steep and gullied. A stony development of this soil occurs on the rougher areas, and typical Canyon gravelly sandy loam occurs where the surface is smoother and less eroded. A common feature of the rougher country is the hard, nearly white, calcareous conglomerate of the Ogallala formation which caps the hills and ridges in many places.

This soil is droughty and unsuited to agriculture. Cattle raising is the principal industry, and most of the soil is used for pasture. It affords some grazing and supports a fair growth of sand, needle, bunch, grama, buffalo, and wire grasses. Yucca grows in places. The land should be left with its native covering of grasses, as it erodes badly when it is disturbed.

This soil is usually sold in connection with adjoining soils of higher agricultural or grazing value. Its current value is $10 or $12 an acre.

CANYON LOAM

Canyon loam consists of brown or grayish-brown friable loam, 8 or 10 inches deep, which gradually becomes lighter with depth to the bedrock formation. The soil profile is similar to those of the Rosebud soils, but the white layer is absent, as sufficient time has not elapsed for its formation.

As mapped in this county, Canyon loam comprises two distinct soils. One consists of friable loam which becomes lighter in color as the parent rock is approached, and which, although the subsoil is calcareous, does not have the white accumulation characteristic of the Rosebud soils. This is the true Canyon loam. The other soil has a shallow brown surface soil which grades to a white, floury calcareous subsoil which is underlain, at a slight depth, by the parent rock. This second soil is technically Rosebud loam, shallow phase, but owing to the intermingling of the two soils it is deemed impracticable to separate them. Both owe their origin to rapid erosion by which the surface soil has been removed as fast as weathering has broken down the parent rock. The underlying rock is everywhere near the surface and over much of the area it is exposed in patches, giving a white, spotted appearance to the hills. Patches of Canyon silt loam, too small to be mapped, are included with mapped areas of Canyon loam. The silt loam member of the series differs from the loam member only in having a slightly higher content of fine material in the surface soil.

Canyon loam occurs scattered through the upland but most abundantly in irregular areas about the heads of drainage ways where

erosion is more rapid. Areas are rolling or hilly, the soil occurring on winding ridges, isolated knobs, and low mounds in the more level parts of the county. Drainage is almost everywhere excessive. This soil is not so badly dissected as areas of rough broken land.

Owing to its porous structure, its surface features, and the closeness of the underlying rock to the surface, the soil is droughty and unsuited for cultivation. It is used chiefly for pasture and supports a fair growth of nutritious grasses among which are grama grass, buffalo grass, the sedge blackroot, and others.

This soil is usually sold in conjunction with adjacent cultivated soils which determine its selling value.

DAWES SILT LOAM

Dawes silt loam, to a depth of 10 or 12 inches, consists of dark grayish-brown or very dark grayish-brown friable silt loam. This darker color serves to distinguish the soil from the somewhat lighter colored Rosebud soils. The surface soil is comparatively rich in organic matter. It contains, in places, a small admixture of fine rounded quartz and feldspathic pebbles strewn over the surface, but these in no way affect the texture of the soil. The upper part of the subsoil, to a depth of 20 or 24 inches, is dark-brown, dark grayish-brown, or dark-gray compact, friable silt loam or silty clay loam material. The lower part of the subsoil is light gray or almost white, highly calcareous, loose floury silt or silty clay material. The characteristic feature of the Dawes soils is the compact upper part of the subsoil, which varies considerably in thickness. In some places it continues to a depth of 30 inches; in others it has an average thickness of about 12 inches. Over some of its area the lower layer approaches silty very fine sandy loam in texture and contains a small quantity of fine gravel.

Dawes silt loam is very uniform over large areas. The thickness of the heavy layer may vary within short distances, but the average depth to the white calcareous layer is much greater than it is in the Rosebud soils. In the deeper depressions, where the soil and upper part of the subsoil are dark colored, the subsoil in many places is tough and compact, in contrast to its typically friable and moderately compact structure with little or no tendency toward a hardpan.

Dawes silt loam occurs in areas of varying size on the southern upland plain. It occupies flat or gently undulating land where drainage ways are in their initial stage of development. The nearly level surface favors the retention of moisture, giving the soil a slight advantage over the Rosebud soils and making it equally favorable for extensive farming and for the use of motor machinery.

Dawes silt loam is mainly residual in origin, being derived by weathering from the white calcareous silty and fine sandy Ogallala formation. The surface has been slightly modified by wind action and by the addition of some sheet-water wash from higher areas.

A large part of this soil is under cultivation. About 30 per cent of it is included in pasture land. It is well adapted to agriculture under the prevailing climatic conditions. The native grasses include luxuriant growths of buffalo grass, grama grass, and western wheat-

grass. The livestock industry consists of the raising of beef cattle, most of which are sold as stockers and feeders. Many farmers on this soil have a few milk cows to supply the home needs. Surplus dairy products are sold. A few hogs are raised, though the present low market value has tended to retard this industry.

Wheat and corn are the principal crops. Wheat is the cash crop. Fair yields are obtained in seasons of normal rainfall, winter wheat yielding from 10 to 30 bushels to the acre and spring wheat somewhat less. Under summer-tillage methods from 20 to 50 bushels are obtained, but the average yield is between 25 and 30 bushels. Corn yields from 10 to 25 bushels, occasionally higher, and averages about 15 bushels. The crop is attacked by cutworms and smut, and on account of the short frost-free season the kernels are frequently soft and immature. Barley produces from 15 to 40 bushels to the acre, and millet from 1 to 2 tons of hay or from 20 to 35 bushels of seed. Oats do well, but are occasionally injured by warm winds at critical periods. Sorghum, Sudan grass, and kafir are good forage crops and yield an average of about 3 tons to the acre. Potatoes thrive, but are grown mainly for home use. Alfalfa is grown on a number of patches, and yields about 2 tons to the acre from two cuttings. Occasionally the crop affords three cuttings, when the total yield is greater. The excellent lime content of the soil adapts it well to this crop.

No definite rotation is practiced, as the soil is not yet impoverished through cropping. New land is plowed to a depth of 3 or 4 inches, usually with a tractor and heavy plows. The prevailing custom is to plow every two or three years. Small grains are usually drilled in old corn or stubble ground, though some winter wheat is seeded between the corn rows. Most of the corn is listed, as moisture conditions discourage extensive surface planting. Small acreages are planted on newly broken sod land. Plowing, disking, and seeding are often done in one operation with the use of tractors. No fertilizers are used, but occasionally barnyard manure is applied with beneficial results.

The sale value of this land ranges from $55 to $125 an acre, depending on local conditions. Some farms are held for higher prices, depending on improvements and location with respect to markets.

This is a strong soil, and fair or good yields are obtained, except in the driest years. Frequent cultivation is considered desirable to maintain a loose surface mulch, which prevents the excessive evaporation of moisture. A dust mulch is undesirable. Some farmers cultivate the land during periods of long drought as well as immediately after rains.

CHEYENNE GRAVELLY SANDY LOAM

To a depth ranging from 15 to 18 inches, Cheyenne gravelly sandy loam consists of grayish-brown gravelly sandy loam. This is underlain by grayish-brown calcareous gravelly sandy loam containing large quantities of coarse sand and gravel. Below a depth varying from 30 to 36 inches is a coarser substratum which extends below a depth of 3 feet and is slightly calcareous. In many of the smaller draws, the surface soil consists simply of loose, porous masses of unconsolidated grayish gravel and different grades of sand. In

places there is practically no difference between the topsoil and subsoil. The surface soil is sandy loam and, at some depth, a loose, unconsolidated mass is everywhere present. The presence of fragments of lime-cemented sandstone indicates the calcareousness of the material over which the soil has been developed. The parent material was composed of coarse sediments washed down from the Ogallala formation and redeposited in the valleys when the streams were swollen by torrential rainfall.

This soil occurs as narrow strips of alluvial wash in the beds of the larger intermittent streams and on terraces of North Platte River and some of its tributaries. The areas range in width from several rods to more than one-eighth of a mile along the larger streams. Owing to the exceedingly open structure of the topsoil and subsoil, drainage is in most places excessive and a droughty soil results.

Where the surface soil is loose and unconsolidated, the land is nearly worthless, hardly producing enough grasses to pasture. These areas support sparse growths of sand reed grass, thin patches of buffalo grass, and a little ragweed. The better areas, where the gravel beds lie deeper, support some western wheatgrass, wire grass, and sage (*Artemisia frigida*).

Under irrigation and better dry-farming methods, some crops can be successfully grown on this soil where it is not too droughty. Among these crops are wheat, corn, potatoes, garden truck, and alfalfa. Neither corn nor wheat does exceptionally well, but fair crops are obtained in good years. The soil is well adapted to potatoes and garden truck. The cultivated acreage does not promise to increase, owing to the droughtiness of the soil. The crops are used for cattle and hog feed.

This land currently sells for prices ranging from $10 to $25 an acre, depending on location, improvements, and utilization.

CHEYENNE FINE SANDY LOAM

Cheyenne fine sandy loam has a brown or grayish-brown friable silty fine sandy loam surface soil from 12 to 15 inches deep. In places the percentage of fine material in the surface soil is very high, giving a true fine sandy loam texture, whereas in other places the material is very coarse and in reality constitutes sandy loam. These areas, however, are comparatively inextensive and are included with the heavier soil in mapping. The subsoil is a loose, incoherent mixture of fine sand and gravel, chiefly quartz and pinkish feldspathic fragments, grayish brown or light grayish brown in color. Some areas have a high silt content, and in many places both topsoil and subsoil contain numerous fragments of lime-cemented sandstone. At a depth of 30 or more inches, the substratum is composed largely of coarse sand and gravel which tend to make the soil droughty.

This soil is not very extensive. It occurs as narrow areas on the terraces and first bottoms of North Platte River and its tributaries and on a few of the colluvial slopes of Blue Creek. In many places it is associated with small areas of Cheyenne gravelly sandy loam. It has been derived from the same materials as the other Cheyenne soils and represents a gradation between the gravelly sandy loam and loam members of this series.

Drainage is everywhere adequate and in many places is excessive, owing to the porosity of the topsoil and subsoil. Areas are almost flat, sloping gently down the valley toward the stream channel.

This soil is of minor agricultural importance. It is droughty under any but the best dry-farming conditions and under irrigation. Part of it is under cultivation, and the remainder is used for grazing and for hay land. The native grasses include wire grass, buffalo grass, and very thin growths of western wheatgrass. Beef cattle, principally grade Hereford and Shorthorn, are grazed on the uncultivated areas. Wheat, corn, and potatoes are grown to a small extent, and where sufficient moisture is available good yields are obtained. The same varieties of crops are grown and about the same cultural methods are followed as on the heavier terrace soils, but the yields are small owing to injury from drought. The crop yields depend entirely on the depth to the gravel layer and on the quantity of water available.

This soil has a current selling value ranging from $20 to $35 an acre, based on location, improvements, and crop adaptation.

In cropping this soil, care must be taken to prevent blowing. Special methods of tillage should be adopted. Wheat should be drilled among the corn rows and corn rows should run east and west. The productivity of the soil could be increased by the application of barnyard manure and other organic matter. This practice would also further aid in checking wind erosion.

TRIPP FINE SANDY LOAM

The topsoil of Tripp fine sandy loam is dark grayish-brown or very dark grayish-brown fine sandy loam, 10 or 12 inches deep. The surface layer, a few inches thick, is somewhat darker than the lower part of the topsoil, owing to its higher content of organic matter. The subsoil consists of lighter grayish-brown or light-gray friable, loose silt loam or fine sandy loam material which is highly calcareous. Although fine material is present in the lower areas of the soil, the surface contains much coarse material and is subject to wind erosion when plowed.

This soil is mapped in patches along North Platte River and Rush Creek. It occurs on the low terraces above overflow and is composed of sediments carried down from the adjoining uplands and deposited when the streams were flowing at a higher level than at present. Areas are flat or gently undulating, but drainage is good as the slope is sufficient to carry off surplus water and the porosity of the subsoil favors underdrainage.

Tripp fine sandy loam is unimportant agriculturally on account of its small extent. Less than 50 per cent is in cultivation. The remainder is used for pasture and hay land. It supports a sparse growth of grama and buffalo grasses, with very thin stands of Stipa and sand reed grass in the lower places. The common weeds are blazing star, broomweed, muletail weed, and gum weed. Russian thistle invades the cultivated fields.

The principal crop is corn. This is fed to cattle and hogs. Owing to the sandiness of the soil corn does well under normal rainfall conditions.

Owing to its small extent in the county no valuation can be given on this land.

TRIPP VERY FINE SANDY LOAM

The topsoil of Tripp very fine sandy loam is dark grayish-brown or very dark grayish-brown very fine sandy loam 10 or 12 inches deep. A slight tendency toward compactness exists in the topsoil in places, but for the most part the material is loose and friable. The surface layer in many places is darker in color and the organic matter content is higher than in Tripp fine sandy loam. As a result, wind erosion is not so severe. The soil is moderately calcareous, the lime content increasing with depth. Below a depth of 12 inches, the subsoil consists of slightly lighter colored loamy very fine silty sand material which grades rapidly to almost white, loose, floury, very calcareous silt having a smooth feel. In many places the silt is yellow in color and resembles the subsoil of Rosebud very fine sandy loam.

There is considerable variation over this soil. Where drainage is poor, the surface soil is very light in color, being either light gray or light brown. On old terraces, on the other hand, brown and darker colors prevail, and the material is slightly sticky. In the subsoil layer, especially in North Platte Valley, thin layers of finer and coarser materials are present in places. In other places no distinct zonation in either topsoil or subsoil is evident, and little change takes place to a depth of 3 feet. This condition is probably explained by the fact that the material is of such recent deposition that it has not leached sufficiently to produce the gray or grayish-white color characteristic of the soils of this series. The materials are of recent terrace deposition, the original deposits having been modified by colluvial wash from the adjacent uplands and by the addition of some wind-blown silt and fine sand.

Tripp very fine sandy loam occurs in irregular areas on the low and high terraces along North Platte River, Blue Creek, and Lost Creek. The most uniform areas are in North Platte Valley. The land is almost flat, sloping very gently toward the main streams. Drainage is fairly good, as the topsoil and subsoil are in most places sufficiently porous to carry off the surplus water.

About 40 per cent of this soil is in cultivation, and the remainder is used as pasture and hay land. The native vegetation consists of western wheatgrass, Indian grass, and sand reed grass. Russian thistle is a common weed. Sweet clover thrives along the roadsides where drainage is poor, and marginal encroachments of this legume on areas adjacent to members of the Laurel series of soil are not uncommon.

Tripp very fine sandy loam is well adapted to all the common crops. Potatoes, corn, wheat, oats, alfalfa, and vegetables are grown. Corn yields from 15 to 35 bushels to the acre, wheat from 10 to 30 bushels, and oats from 20 to 50 bushels. Alfalfa is cut two or three times, depending on the season and irrigation facilities. Potatoes and vegetables are grown for home use.

The land is prepared in the spring as soon as the frost is out of the ground. Old fields are plowed every third or fourth year. Corn or wheat stubble is generally prepared for small grain by double

disking. No definite crop rotation is practiced and no commercial fertilizers are used.

This land sells for prices ranging from $50 to $75 an acre, depending on the location, surface features, improvements, and the possibilities of irrigation.

Tripp very fine sandy loam is very productive, is easily managed, and is remarkably retentive of moisture. Because of the fineness of its materials there is only slight danger of wind erosion. Careful management and occasional applications of barnyard manure tend to increase the organic-matter supply and to stabilize the soil. This soil is well adapted to irrigation because of its excellent underdrainage. A larger acreage could profitably be brought under irrigation.

TRIPP SILT LOAM

The surface soil of Tripp silt loam consists of dark or very dark grayish-brown fairly heavy but friable silt loam 10 or 12 inches deep. The color in this layer depends on the quantity of organic matter present. Most of the material is fine and contains little sand of any grade. This material is underlain by a layer of slightly heavier silt loam which is moderately calcareous and varies from 3 to 6 inches in thickness. In some areas this layer is absent. The lower part of the subsoil consists of characteristic gray or yellowish-gray highly calcareous silt or silt loam material. This continues to a depth of 3 feet though in many places it grades to silty very fine sandy loam. The soil consists of reworked alluvial and colluvial sediments washed down from the uplands and from the more elevated regions to the west.

Tripp silt loam occurs principally on the high and low terraces of North Platte River, Blue Creek, and Ash Creek. It comprises a moderate acreage among the terrace soils of the county. One of the larger and more typical areas is about 1 mile northeast of Lewellen in North Platte Valley. Another large area is about a mile northeast of Olson School.

Areas of this soil are level or gently undulating but slope slightly toward the stream channel. The surface drainage is in most places sufficient and the subsurface drainage is adequate.

Nearly 80 per cent of this soil is under cultivation. The remainder is used as pasture and hay land. Its total area is small, but it is a fairly important agricultural soil. Buffalo grass, western wheatgrass, big bluestem, and Indian grass constitute the principal native vegetation. The sand reed grass found on Tripp very fine sandy loam is lacking on this soil. Salt grass has encroached on the poorly drained areas, and wild alfalfa (*Psoralea tenuiflora*) flourishes in the pastures. Sweet clover thrives along the roadsides, and areas affected by seepage water from the irrigation ditches support dense growths of giant ragweed, sunflowers, and pigweed.

Corn, alfalfa, and sugar beets constitute the major crops. Sugar beets, the cash crop, are the most important crop on irrigated land. From 10 to 15 tons to the acre are produced. When irrigated, corn yields from 20 to 50 or more bushels to the acre. Alfalfa yields a total of 3 or 4 tons from three cuttings. Minor crops include oats, barley, potatoes, and vegetables. On the unirrigated land native hay yields from one-fourth ton to 1 ton to the acre, depending on the

season. This soil will support from 30 to 40 head of cattle a square mile throughout the year. Most of the corn is fed on the farms where it is produced. Most farmers snap the ears and store them for winter feed, but some cut the corn for fodder.

This soil is managed in much the same manner as the heavy upland soils. The surface features favor the accumulation and retention of moisture. No definite crop rotation is practiced, as the productiveness of the soil is not considered in immediate danger of exhaustion. No commercial fertilizers are used, but barnyard manure is occasionally applied to the fields.

Tripp silt loam currently sells at prices ranging from $55 to $200 an acre, depending largely on irrigation possibilities, improvements, and location.

Owing to the high productiveness of the soil under favorable moisture conditions or under irrigation, it should prove profitable to plant a larger acreage to corn and alfalfa. The land is too valuable to be used solely for pasture. At present no injurious accumulation of alkali is present in the soil, but care should be exercised to prevent salts from concentrating near the surface.

BRIDGEPORT FINE SANDY LOAM

Bridgeport fine sandy loam consists of dark grayish-brown loose friable fine sandy loam which changes little in color or texture to a depth of 3 feet. Owing to its higher content of organic matter, the surface layer is in places slightly darker than the rest of the soil. The surface soil is slightly calcareous, and the subsoil has a moderate lime content. It lacks, however, the characteristic white layer seen in Tripp fine sandy loam.

This soil occurs in irregular areas on the high and low bench lands along North Platte River, Rush Creek, Blue Creek, Ash Creek, and other tributaries. Areas are slightly rolling or gently undulating, and drainage is adequate because of the porosity of the topsoil and subsoil.

Bridgeport fine sandy loam is important agriculturally. About 40 per cent of it is under cultivation, and the rest is used as pasture and hay land. The native vegetation consists of Stipa, sand reed grass, redfieldia, and some big bluestem. From one-fourth to one-half ton of hay to the acre can be cut. From 15 to 20 acres are required to pasture one cow or steer throughout the year. Corn, sorghum, potatoes, rye, and alfalfa, under irrigation, are profitable crops.

The surface of this soil is subject to blowing, and care must be exercised after the removal of the native grass to maintain as rough a surface as possible. The current selling price ranges from $10 to $15 an acre, without irrigation facilities.

Most of this soil is adapted to irrigation, as the porous soils would afford excellent drainage and tend to prevent accumulations of alkali. Under irrigation Bridgeport fine sandy loam could be made as productive as any of the Tripp soils.

On account of its small area, a sandy loam of the Bridgeport series has been included with this soil in mapping. This soil is coarser and looser than the typical fine sandy loam and the color is somewhat lighter on account of its smaller content of organic mat-

ter. This soil occupies the low benches along North Platte River and Coldwater Creek, where it occurs in several irregular areas. The agricultural value of this soil is lower than that of the fine sandy loam of the series.

A small acreage of fine sandy material has been included with this soil in mapping. This, if it had been of sufficient extent to indicate on the map, would have been correlated as Bridgeport fine sand, rolling phase. The soil consists of loose grayish-brown fine sand which shows little change in color or texture to a depth of 3 feet. It occurs on colluvial slopes on the south side of North Platte River. The material is wind-blown sand modified to some extent by colluvial wash. This sand blows and drifts if the surface is broken. For this reason very little of the soil is under cultivation.

BRIDGEPORT VERY FINE SANDY LOAM

Bridgeport very fine sandy loam, to a depth of 15 or 18 inches, is loose, mellow very fine sandy loam, grayish brown or dark grayish brown in color, except for the immediate surface which is darker on account of a larger content of organic matter. Although the subsoil in most places shows little change in color or texture, in some places it is gray or grayish brown, slightly coarser in texture, and slightly calcareous.

This soil occurs as irregular areas on the high terraces of North Platte River and the low terraces of Ash Creek, Plum Creek, and Blue Creek. Areas are flat, but drainage is adequate, owing to the porosity of the subsoil and substratum which allow the downward escape of surplus water.

Although this soil is of only moderate extent, it is very important agriculturally on account of its productiveness and suitability for irrigation. About 60 per cent is under cultivation. Part of this area is irrigated, and the remainder is used for pasture and hay production. The native vegetation consists of western wheatgrass, grama grass, buffalo grass, big bluestem, and salt grass along the margins bordering the Laurel soils. Native hay yields from one-fourth to one-half ton to the acre, depending on the season, and a section of land (640 acres) will support from 30 to 40 head of livestock throughout the year.

Sugar beets, potatoes, wheat, corn, oats, and alfalfa constitute the principal crops. The feed crops are either used on the farm or are sold locally. The sugar beets are shipped to the sugar factories in Morrill and Scotts Bluff Counties.

In the dry-farming areas, wheat yields from 7 to 25 bushels to the acre, corn from 8 to 30 bushels, potatoes from 50 to 125 bushels, and oats from 20 to 40 bushels. Sugar beets are irrigated and yield from 10 to 15 tons to the acre. Under irrigation, corn yields from 20 to 40 bushels to the acre, wheat from 15 to 30 bushels, potatoes from 100 to 175 bushels, and alfalfa about 4 tons a season from three cuttings.

No definite system of crop rotation is followed on this soil, but farming methods are very similar to those practiced on Tripp very fine sandy loam. The soil has a very favorable structure for dry farming. It is naturally productive, remarkably retentive of mois-

ture, readily works into a good tilth, and yields well. The land under irrigation could, in part, be profitably planted to sugar beets.

The current selling price of Bridgeport very fine sandy loam ranges from $35 to $200 an acre, depending on location and improvements.

BRIDGEPORT SILT LOAM

Bridgeport silt loam, to a depth of 10 or 12 inches, is dark grayish-brown friable silt loam. The immediate surface is in many places darker in color, as the soil here is rich in organic matter. There is little change in texture throughout the soil, but the color fades gradually with depth. Below a depth of 30 inches, the material is slightly calcareous, and although it has the appearance of being slightly compact it breaks easily into loose, friable silt loam. Owing to its fine texture and high content of organic matter, the soil is not so subject to wind erosion as are the other members of the Bridgeport series. It consists of colluvial and alluvial material washed from the adjoining uplands and carried in by the main stream from the higher regions to the west. It retains moisture well and is an excellent soil for dry farming as well as for irrigation.

This soil, with its basin phase, is an extensive alluvial soil occurring in small areas on the high and low benches of North Platte River. By far the greater part of it occupies smooth, undulating slopes, and even the more nearly level areas slope gently toward the main stream. The slope is generally sufficient to carry off the surplus water, and the porous subsoil affords ample underdrainage.

This is an unimportant soil agriculturally. Only a small part of it is under cultivation, the remainder being used as pasture for beef cattle and horses and for hay production. The native vegetation consists of grama grass, buffalo grass, and western wheatgrass. From 7 to 10 acres of pasture are required for each animal. An acre yields from one-fourth to one-half ton of hay, depending on the season.

In the dry-farming areas, corn yields from 10 to 25 bushels of grain or from 2 to 3 tons of forage to the acre; wheat, from 10 to 30 bushels; oats, from 15 to 40 bushels; and alfalfa, from 1½ to 2½ tons of hay a season.

The current selling price of this land ranges from $40 to $75 an acre, depending on improvements, distance from market, and irrigation possibilities.

Bridgeport silt loam is naturally productive and under irrigation yields as well as other bench-land soils. Much of the land used for pasturage, hay, and crops is suited to irrigation.

Small areas of Bridgeport loam have been included with this soil in mapping. These occur on low terraces along Blue, Lost, and Plum Creeks. This soil differs from the typical silt loam only in containing a smaller proportion of silt and a larger proportion of fine sand in the surface soil.

Bridgeport silt loam, basin phase.—The topsoil of Bridgeport silt loam, basin phase, is dark grayish-brown, mellow silt loam 12 or 15 inches deep. The subsoil is of similar or slightly heavier texture but in most places the color and texture do not change throughout the soil. In places, a white or yellowish-white calcareous subsoil, which is characteristic of the Rosebud soils, is present at a depth varying from 36 to 40 inches. This basin soil is not highly calcareous, but

the subsoil in places shows a slight reaction with dilute hydrochloric acid. This soil has been derived from wash from the higher surrounding soils.

Except in the loess areas the basin phase of Bridgeport silt loam occurs in irregular areas scattered over the entire uplands of the county. These areas are flat, the soil occurring in depressed basins surrounded by bodies of the upland soils. One large and very typical area is just west of the loess ridge and east of Kowanda School. Owing to the porosity of the topsoil and subsoil, this soil is adequately drained.

Although this soil is of small extent, it is one of the most important agriculturally in the county. It is productive, retentive of moisture, and well adapted to farming in a region of light rainfall. About 40 per cent is under cultivation, the remainder being used for pasture and hay production. It supports a dense growth of buffalo and grama grasses with some blackroot and western wheatgrass. From 5 to 7 acres are required for one cow or horse. Shorthorn and Hereford grades are the favorite beef cattle. They are sold principally as stockers and feeders.

All the grains common to the region can be successfully grown on the soil. Wheat is the principal cash crop. Both spring and winter varieties are grown, the latter occupying the greater acreage. Turkey and Kanred are the principal varieties. Corn does well, the dent varieties being the favorites. Oats are grown chiefly for feed.

Wheat yields from 10 to 25 bushels to the acre under ordinary dry-farming conditions; corn averages about 20 bushels, but the yields vary widely with the rainfall; and oats yield about 30 bushels.

Owing to the friability of the soil, no greater care is required in cultivation than is necessary on other important upland soils. No definite crop rotation is followed, and no fertilizers are used as the land seems to be in no immediate danger of exhaustion.

Bridgeport silt loam, basin phase, currently sells for prices ranging from $50 to $85 an acre, depending on the location and improvements.

YALE VERY FINE SANDY LOAM

Yale very fine sandy loam consists of dark or very dark grayish-brown very fine sandy loam, from 15 to 18 inches thick, underlain by heavy, compact brown silt loam or loam material which continues to a depth greater than 3 feet or which, at a depth of 15 or 18 inches, becomes lighter in color and effervesces with acid. The upper 10-inch layer of the soil is slightly darker than the remainder owing to the presence of more organic matter. The lower part of the subsoil is, in many places, very sandy and highly calcareous. Although the surface soil shows a low lime content, there is no evidence of a deficiency of this material.

Only a few areas of this soil are mapped. These occur on the low second bottoms south and east of Oshkosh in North Platte Valley. Areas are nearly flat, sloping gently with the valley and toward the main axis of the river channel. In general, drainage is adequate though water occasionally stands a day or two in some of the lower depressions.

Although of small total extent, this soil is important agriculturally, as nearly all of it is under irrigation. The remainder is used

for pasture. The native vegetation consists mainly of salt grass and Indian grass. The principal crops include sugar beets, corn, and alfalfa. Sugar beets, the principal cash crop, yield from 10 to 15 tons to the acre. Dent varieties of corn are most popular. Under good irrigation practices yields of 40 or 50 bushels to the acre are obtained. Alfalfa yields 3 or 4 tons of hay to the acre from three cuttings.

Under favorable moisture conditions, this soil is easily worked and maintained in good tilth. It retains moisture well and is highly productive.

YALE SILT LOAM, BASIN PHASE

Yale silt loam, basin phase, differs from typical Yale silt loam mainly in being less friable. The surface soil is dark or very dark grayish-brown silt loam containing a large quantity of organic matter and continuing to an average depth of 10 or 12 inches. It is underlain by dark-gray or grayish-brown compact silt loam or silty clay loam which typically continues to a depth of 3 feet. In places white, floury, highly calcareous material, similar to the subsoil of the Rosebud soils, over which this soil has developed, is present at a depth of 36 inches. This soil differs from Bridgeport silt loam, basin phase, in having a heavy and stiff subsoil. The material has been derived from sediments brought down by sheet water from the surrounding higher soils and deposited in basins having drainage inferior to the corresponding phase of Bridgeport silt loam.

This soil is widely distributed about the southern uplands of the county. It occurs in more or less rounded areas occupying shallow depressions. The surface is flat or depressionlike. Drainage is barely adequate and in places is deficient.

Yale silt loam, basin phase, is an important agricultural soil. Most of it is under cultivation, but a small percentage is in pasture. The native grasses include western wheatgrass, buffalo grass, and small growths of grama grass. Wheat and corn are the principal crops, wheat being the cash crop and occupying the largest acreage. Under ordinary dry-farming practices, wheat yields range from 10 to 35 bushels to the acre, depending on the season. Both winter and spring varieties are planted, but the winter varieties yield better. Turkey is the most common variety, but Kanred is gaining favor in some communities. Corn produces from 15 to 30 bushels to the acre. The dent varieties are most popular.

Tillage practices are similar to those on the upland soils in conjunction with which these areas are farmed. The wheat and corn are generally taller, producing greater vegetative growth in these basins of stronger soil more favorable for the accumulation and retention of moisture. No commercial fertilizers are applied.

The current selling price of this land ranges from $70 to $100 an acre, depending on the location and improvements.

LAUREL VERY FINE SANDY LOAM

Laurel very fine sandy loam in many places has a surface layer of grayish-brown light loam or silt loam, from 4 to 6 inches deep. This grades to dark grayish-brown friable very fine sandy loam which is highly calcareous. The subsoil, which occurs at a depth

ranging from 12 to 15 inches, is gray or light-brown very fine sandy loam or loam. Throughout the subsoil there are alternate light and heavy layers, none of which is coarser than fine sandy loam or heavier than silt loam. This condition may continue throughout the subsoil or at a depth of about 36 inches the material may be fine gravel or sand. All these subsoil layers have a high lime content and effervesce freely with dilute hydrochloric acid. This soil is deficient in organic matter. It consists of recently deposited alluvium, and in many places is in the process of formation at the present time.

Laurel very fine sandy loam occurs on first bottoms of North Platte River and as strips adjacent to Lost and Rush Creeks. It is subject to frequent overflow and to the deposition of additional sediment by streams. Some areas of the soil are nearly flat, and in places drainage is poor. In other areas the drainage is sufficient for the production of grain crops.

This soil does not cover a large total area and is not important agriculturally. The greater part of it is used for pasture. The native vegetation consists principally of salt grass, big bluestem, Indian grass, and some switch grass (*Panicum virgatum*). In small areas, especially along the roadsides, there is a good growth of sweet clover. This soil produces excellent hay, nearly as good as that produced on the Cass and Sarpy soils of western Nebraska. From 1 to 1½ tons to the acre are cut. Due to subirrigation, corn and alfalfa are profitable crops. Corn yields from 15 to 50 bushels to the acre and alfalfa from 2 to 4 tons of hay from three or four cuttings, depending on the season.

Laurel very fine sandy loam currently sells at prices ranging from $50 to $85 an acre, depending on the location and improvements.

Because of the excellent pasture conditions and of the adequate supply of water from the perennial streams along which it occurs, dairying could profitably be developed on this soil. The introduction of purebred dairy cows would materially strengthen the industry.

Some patches of fine sandy loam have been mapped with this soil on account of their small total area. These consist of grayish-brown or light grayish-brown fine sandy loam from 12 to 15 inches thick, underlain by light grayish-brown or gray very fine sandy loam, which continues to a depth ranging from 24 to 30 inches. The lower part of the subsoil is dark-gray heavy loam or silt loam, containing some very fine sand. The soil is calcareous throughout, the subsoil effervescing freely with acid. There is considerable variation in the character and arrangement of the various layers of the soil. This soil occurs only in small areas in North Platte Valley. It occupies a low position on the flood plain and is subject to overflow.

LAUREL SILT LOAM

Laurel silt loam consists of brown, dark-brown, or grayish-brown sticky and plastic heavy silt loam, from 8 to 10 inches deep, which grades to lighter colored grayish-yellow or grayish-brown more friable silt loam. The lower part of the subsoil, which occurs at a depth ranging from 20 to 24 inches, is heavy plastic gray or light-gray silt loam or silty clay loam. This material either continues to a depth of 3 feet or grades to fine gravel and sand. Both topsoil and

subsoil are highly calcareous. This soil material has been derived from sediments brought down from light-colored formations of heavy texture to the west, and some of it is in the process of formation at the present time.

Laurel silt loam occurs only on the first bottoms along North Platte River and Blue Creek. The largest and most typical area is west and south of Oshkosh. The land is subject to inundation during periods of high water. Areas are flat and drainage, in general, is poor, especially near old channels of the river.

Although this soil is of small total extent, it is important in the production of sugar beets. Other crops include corn, alfalfa, and native hay. The native grass is principally salt grass (*Distichlis spicata*). Switch grass (*Panicum virgatum*) grows along the roadsides, and western wheatgrass, which abounds in the better drained localities, furnishes hay of the highest food value. Salt sage (*Atriplex* sp.) and Dondia thrive in the very alkaline areas.

Sugar beets are produced only with irrigation. They yield from 10 to 15 tons to the acre. Corn does well; and alfalfa, because of subirrigation, is a profitable crop after stands are established. Difficulty is experienced in getting a stand of alfalfa on lands especially saline, but flooding the surface before planting and covering with a mulch prevents evaporation with its consequent incrustation of alkali until the young plants are of sufficient height to shade the ground. Native hay yields an average of 1 ton to the acre. In cropping no definite rotation or method of planting and managing the soil has been worked out, but general practice follows three crops of sugar beets with an equal number of other crops.

SARPY VERY FINE SANDY LOAM

Sarpy very fine sandy loam, to a depth of 12 or 15 inches, is gray or grayish-brown very fine sandy loam containing a large proportion of fine sand. The upper part of the subsoil, into which the topsoil grades almost imperceptibly, is lighter brown or grayish-yellow fine sandy loam containing rust-brown streaks. The lower part of the subsoil, which occurs at a depth ranging from 24 to 30 inches, is grayish-yellow or gray loamy fine sand or sand containing a little organic matter and some fine gravel. The substratum consists of fine and coarse gravel with a mixture of sand of all grades. The surface soil is generally well supplied with organic matter and contains a large quantity of lime. The principal variations in texture are toward loam and fine sandy loam. In places there is only a thin layer of soil rich in organic matter, underlain by yellowish-gray incoherent fine sand. The strip mapped along Blue Creek varies from fine sand in the vicinity of its mouth to coarse sand near the headwaters. In places which are favorable for the accumulation of plant growth, a soil closely resembling muck has developed. The subsoil is dark-gray incoherent fine sand or gravel saturated with water. It is poorly supplied with organic matter and is compact.

Sarpy very fine sandy loam occurs exclusively on the first bottoms of North Platte River and Blue Creek, fringing the channel on both sides. Areas vary from nearly level to slightly uneven and hummocky. Surface drainage is fairly adequate because of the porosity

of the soil, but owing to its position, the water table approaches the ground level very closely during high water.

This soil is used solely for pasture and the production of hay. For these purposes it is unexcelled by any soil in the county. It supports a luxuriant growth of big bluestem and Indian grass, a scant growth of switch grass, and in lower, wetter spots, a growth of cat-tails and slough grasses. Yields range from 1 to 1½ tons to the acre, from one-half to 1 ton more than on the Laurel soils. The crop is very dependable, owing to subirrigation.

SARPY SILT LOAM

Sarpy silt loam differs from Sarpy very fine sandy loam chiefly in texture and in the darker color of the topsoil and upper part of the subsoil. The surface soil consists of gray heavy silt loam from 10 to 12 inches deep. This is underlain, to a depth ranging from 24 to 30 inches, by light-brown or grayish-brown very fine sandy loam. The lower part of the subsoil, which occurs at a depth ranging from 24 to 30 inches, is light-gray or yellowish-gray loamy fine sand or sand containing a large quantity of gravel and very little organic matter. This material is similar to that of the lower part of the subsoil of Sarpy very fine sandy loam. The substratum consists of fine and coarse gravel intermixed with all grades of sand. Both topsoil and subsoil effervesce freely with acid. Areas of this soil are slightly irregular, and the low knobs are lighter in texture than the intervening soil mass.

Sarpy silt loam occurs on the flood plain adjacent to North Platte River. It is inextensive. Areas vary from nearly level to slightly hummocky. Surface drainage is fairly adequate, but owing to the low position of the soil the water table closely approaches the surface of the ground during periods of high water.

All of this soil is used for pasture and hay production. The principal grasses are big bluestem and Indian grass. Switch grass grows in some small areas, and slough grasses and cat-tails abound in the swamps. Yields of hay grasses range from 1 to 1½ tons to the acre.

DUNE SAND

The surface layer of dune sand consists of grayish-brown sand, ranging from fine to coarse in texture. It is loose and incoherent and varies from 10 to 15 inches in thickness. The subsoil, to a depth greater than 3 feet, is similar to or coarser than the surface layer and is somewhat lighter in color, owing to the smaller content of organic matter. The sand grains are chiefly quartz and feldspar. When viewed at a distance the dunes have a light grayish-brown appearance when the surface is dry. Both topsoil and subsoil are noncalcareous and poorly supplied with organic matter. Not enough organic matter is present to prevent the soil from blowing when the protective covering of grasses is removed.

Dune sand occurs chiefly in the northern part of the county, but areas of considerable extent lie south of North Platte River. The developments represent the prevailing soil types, the areas being interrupted by narrow basins and pockets.

Areas of dune sand are sharply rolling, wind being the active agent in forming a succession of monotonous dunes varying from 10 to 75 feet in height. In the rougher places "blow-outs" are common, as the soil is subject to active wind erosion. The dunes have a southeasterly trend.

Drainage is adequate throughout this soil, though there are no continuous drainage ways. The loose, porous soil and substratum absorb all the rainfall, even on the steeper slopes. Dune sand is, in general, retentive of moisture, however, considering its loose structure.

Dune sand is of little importance in crop production at the present time. It is used almost exclusively for pasture land, although a small amount of hay is cut on the more level areas. As a rule the surface is covered with a reasonably heavy sod. The characteristic native vegetation is yucca, sand reed grass, redfieldia and Muhlenbergia. Small bunch grass grows in clumps in a few places, and there are scattered growths of cactus and sand sage, and sparse growths of grama grass and buffalo grass where the surface of the ground is more compact. In the grassed pockets of old blow-outs good growths of sand reed grass suitable for hay and, in places, buffalo grass have made a dense growth. Good pasturage may be counted upon for eight or nine months of the year, but the range feed must be supplemented by winter feeding during severe weather. Hundreds of acres are included in large and small ranches.

Areas of dune sand have a current value of about $10 or $12 an acre. The preservation of native sod on this land is the most important item in its agricultural use. Blow-outs and overgrazed patches plainly show the disastrous effects of disturbing the soil-binding root systems. No attempt should be made to cultivate these areas. Prairie fire control is very important.

RIVER WASH

In North Platte River and along the dry channels of small watercourses are some small areas of river wash. These include the sand bars and low islands over and around which the river flows and which are fairly permanent, being held in place by willows and other trees. Coarse sand and gravel make up the greater part of the deposit. The entire mass is open and porous, but shallow beds of silt and clay underlain by sand and gravel occur here and there. River wash lies only a few feet above the normal water level and is subject to periodic overflow. The greater part of the areas in the channel are unmapped as they are small, unimportant, and the material is being washed away in some places and built up in others. A few of the larger areas are grassed in part and are capable of producing some hay.

River wash mapped in dry stream bottoms consists of loose porous masses of grayish loamy sand and gravel. The gravel consists of a great variety of crystalline rocks and ranges in size from small pebbles to stones 2 or 3 inches in diameter. Irregular fragments of the white calcareous Tertiary grit are thickly scattered on the surface. There is practically no difference in the material to a depth of 3 feet. River wash also occurs as alluvial wash in the beds of the larger draws, in strips of different width generally extending down the stream channels for several miles. This material has probably been

carried from the uplands during torrential rains. Most of the areas along the small streams and draws support no vegetation, but where grass grows at all it is only a very sparse growth.

River wash has no agricultural value, either under dry-farming methods or irrigation, but is valuable as a source of gravel for road construction.

ROUGH BROKEN LAND

Rough broken land includes extensive areas of badly eroded stream slopes and bluffs which are unsuited for farming, with the exception of included stream valleys and a few small areas that have escaped severe erosion. This land is extremely rough and broken and abounds in steep slopes, canyons, and gullies. Bedrock crops out over much of the soil and in many places forms cliffs and vertical walls. The material has been carved from the underlying Tertiary formation which is readily broken into a rough surface where erosion is active. A considerable quantity of white calcareous stones which represent unweathered fragments of the underlying sandstone formations is present in most places on the surface. Over much of the area erosion has been so severe that the surface of the ravines and buttes is almost barren, except for a sparse growth of pasture grasses. The streams, which flow in a northerly direction, have a steep gradient and are very swift. Drainage in most areas is excessive, owing to the steep slopes. Most of the soil material is shallow, except along stream channels.

Rough broken land is moderately extensive in Garden County. It occurs chiefly in irregular though continuous areas extending parallel to North Platte Valley, in a northwesterly-southeasterly direction across the county. A few small areas are mapped along Rush and Blue Creeks.

Rough broken land is used exclusively for grazing purposes. There is a good growth of grasses except on the steepest slopes and cliffs. The sedge blackroot, grama grass, buffalo grass, and western wheatgrass are the most important species. These are capable of maintaining from 15 to 20 head of cattle to the square mile throughout the year. The rough surface affords protection to livestock during severe weather. Scrub western yellow pine and western red cedar grow extensively on the steeper slopes, and in the canyons ash, willow, cottonwood, and elm make up the tree growth.

This land is valued only for pasture and can be bought at present for $10 or $15 an acre, depending on the improvements and the distance from market.

Scattered throughout the rough broken land are areas strewn with a great variety of crystalline rocks, consisting of waterworn stones ranging in size from small pebbles to fragments 2 or 3 inches in diameter. The surface of such areas is somewhat more rounded than is typical of rough broken land, but owing to their small extent they are not indicated separately on the map.

SUMMARY

Garden County is in the eastern part of the "panhandle" of Nebraska. It embraces 1,687 square miles or 1,079,680 acres. The land is a part of a former broad plain which has been reduced to

remnants of the original plateau covered in places by sheets of loess, to narrow bands of alluvial land, and to extensive areas of sand deposits. The average elevation is between 3,700 and 3,900 feet above sea level in the uplands, and is 3,200 feet in North Platte Valley.

The county is drained by North Platte River and its tributaries. Most of the major valleys are deeply entrenched, especially in their lower courses. Irrigation projects are developed in North Platte River and Blue Creek valleys. The general trend of the surface slope is southeasterly. Precipitation in the sand hills is absorbed in the loose soil material and is transported by seepage to lower levels where much of it escapes as springs.

In 1920 Garden County had a population of 4,572 all of which is classed as rural. Oshkosh, the county seat, had a population of 707 and is the only incorporated town in the county.

The county has fair transportation facilities, but parts of the sand hills are 25 or 30 miles from a shipping point. The North Platte and South Torrington branch of the Union Pacific Railroad traverses the county and the main line of the Union Pacific in Deuel County serves a part of the south uplands. The main public roads are fairly good, except those in the sand hills. Minor roads receive very little attention. There are several rural mail routes, and all important points are reached by telephone.

Oshkosh, Lewellen, and Lisco are the principal local markets, but some products are handled at Chappell, in the adjoining county to the south. Cattle and hogs are shipped to Omaha. Sugar beets are shipped to sugar factories in Morrill and Scotts Bluff Counties.

The climate of the county is subhumid. The average annual rainfall is about 19 inches, and the frost-free season approximates 150 days. In many years yields are curtailed by drought, especially on the hard lands, but summer tillage of fallow lands is thought to minimize this danger. The climate is the principal controlling factor in agricultural development.

The early history of the county is connected with the Oregon Trail. Cattle raising on the open range marks the earliest agricultural development. Present-day practices include farming, both under irrigation and dry-farming methods, and stock raising, with the production of hay and grain for feed in the rougher areas and in the sand-hill region. No fertilizers are used, as the soils are comparatively new.

Wheat and corn are grown on the largest acreages and are the important crops. Wheat is the cash crop. Wild hay, alfalfa, oats, and rye rank in importance in the order named. Wild hay is the most important source of cattle feed. Alfalfa is the principal leguminous crop. Oats are not considered a profitable crop but are needed for stock feed and are valuable in rotations. Rye is especially adapted to sandy lands. Sugar beets are grown under irrigation. Sorghum, millet, barley, and potatoes constitute the less important crops. Potatoes and vegetables are grown for home use. Orchard fruits, as a rule, do not thrive.

Livestock raising combined with grain farming is an important industry in parts of the county. Cattle raising is conducted in the sand hills. Most of the cattle are shipped as stockers and feeders to Omaha. Grade Hereford and Shorthorn are the principal beef

breeds. Little grain is fed, as the native grasses furnish an abundance of nutritious pasturage and hay. If not shipped in the fall, the animals are run on the range throughout the winter, and are fed hay in severe weather.

There are several dairy herds which consist of grade animals. Many farmers keep a few dairy cows and raise some poultry and hogs.

Sparse growths of natural timber flourish along North Platte River, and the rough broken land supports a scrub growth of cedar and fir.

The staple crops are grown on most of the soils, and dry-farming methods prevail. Corn and wheat are the principal upland hard-land grains. Alfalfa, native hay, and sugar beets produce the highest yields on the alluvial soils which are irrigated or subirrigated. Indefinite crop rotations are followed. Summer tillage, correctly practiced, is believed by many farmers to substantially increase yields and profits. A little manure is applied. The soils are well suited to most of the crops, but yields are irregular as moisture conditions are the chief factor controlling cropping and rotations. Fertilization and tillage methods are of secondary importance. Farm equipment is generally adequate. The buildings, except those in the sand hills, are fairly well constructed. Portable bunk houses are a feature of sod-land farms. The equipment on many farms consists almost entirely of tractors and tractor-drawn implements suited for farming on an extensive scale. The proportion of farms operated by owners is nearly 60 per cent. The share-crop rental system is preferred to the cash-rent system.

Land values range from $10 to $17 an acre for grazing land and are as high as $200 an acre for irrigable land.

Fourteen soil series, embracing 32 types and 7 phases, in addition to 3 miscellaneous classifications, dune sand, river wash, and rough broken land, have been mapped in Garden County.

The Rosebud soils are extensive on the upland. They occur on areas varying from a few acres to large tracts on the table-land and some of the slope land. Rosebud silt loam, with its deep phase, is one of the most important agricultural soils. Most crops common to the region can be successfully grown on these soils, except on the shallow phases which are utilized chiefly for grazing.

Dawes silt loam is an important and very fertile soil in the high plains region. It is deep and productive when moisture is available. Wheat and corn are the principal crops.

Keith silt loam is extremely productive under proper moisture conditions. It is uniform in texture and color and is well adapted to general farming, especially to the raising of small grains.

Colby silt loam is used chiefly for grazing and hay land but the smoother areas are suitable for general farming and are nearly as productive as areas of Keith silt loam.

Scott silty clay occurs in small depressions on the table-lands and alluvial lands. It is of little agricultural value owing to its poor drainage and tough, impervious subsoil.

The Canyon soils are principally nonagricultural soils suited only for grazing. The underlying bedrock formations lie too close to the surface to insure favorable crop production.

The Valentine soils are valuable for general farming, grazing, and hay production. The sandier members are poorly supplied with organic matter and tend to blow when cultivated.

The Cheyenne soils are droughty on account of the porosity of their subsoils. Under irrigation and the best dry-farming methods they are reasonably productive.

The Tripp soils are excellent bench-land soils. They are as productive as the upland Rosebud soils and are well adapted to grain growing. The sandy members are subject to wind erosion.

The Bridgeport soils consist of water-laid materials and are important agriculturally, especially Bridgeport fine sandy loam, which aggregates a large acreage. The heavier members are suited to general farm crops, but the lighter ones are subject to blowing when not properly cultivated.

Although Yale very fine sandy loam is an excellent soil, it is of small extent. It is well adapted to corn and wheat and is retentive of moisture.

The Laurel soils occur on the flood plains of North Platte River and its tributaries. Sugar beets, corn, and alfalfa are grown, and the land produces an excellent native hay crop.

The Sarpy soils occur exclusively on the lowest flood plains of North Platte River and Blue Creek. They are unexcelled for hay production, producing luxuriant growths of big bluestem and Indian grass, with smaller growths of switch grass and slough grass.

Dune sand has a value only as grazing land. The areas of rough broken land are unsuited to farming and most of them are used as pasture lands. River wash is unimportant.

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[Public Resolution—No. 9]

JOINT RESOLUTION Amending public resolution numbered eight, Fifty-sixth Congress, second session, approved February twenty-third, nineteen hundred and one, "providing for the printing annually of the report on field operations of the Division of Soils, Department of Agriculture."

Resolved by the Senate and House of Representatives of the United States of America in Congress assembled, That public resolution numbered eight, Fifty-sixth Congress, second session, approved February twenty-third, nineteen hundred and one, be amended by striking out all after the resolving clause and inserting in lieu thereof the following:

"That there shall be printed ten thousand five hundred copies of the report on field operations of the Division of Soils, Department of Agriculture, of which one thousand five hundred copies shall be for the use of the Senate, three thousand copies for the use of the House of Representatives, and six thousand copies for the use of the Department of Agriculture: *Provided,* That in addition to the number of copies above provided for there shall be printed, as soon as the manuscript can be prepared, with the necessary maps and illustrations to accompany it, a report on each area surveyed, in the form of advance sheets, bound in paper covers, of which five hundred copies shall be for the use of each Senator from the State, two thousand copies for the use of each Representative for the congressional district or districts in which the survey is made, and one thousand copies for the use of the Department of Agriculture."

Approved, March 14, 1904.

[On July 1, 1901, the Division of Soils was reorganized as the Bureau of Soils, and on July 1, 1927, the Bureau of Soils became a unit of the Bureau of Chemistry and Soils.]


RECONNOISSANCE SURVEY
WESTERN NEBRASKA
DAWES
KEYAPAHA
BOYD
BROWN
HOLT
CHERRY
GRANT
HOOKER
BLAINE
LOUP
GARFIELD
WHEELER
ARTHUR
MCPHERSON
VALLEY
GREELEY
KEITH
SHERMAN
LINCOLN
PERKINS
CHASE
HAYES
FRONTIER
GOSPER
DUNDY
HITCHCOCK
RED WILLOW
FURNAS
HARLAN
FRANKLIN
WEBSTER
NUCKOLLS
CLAY

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BUREAU OF CHEMISTRY AND SOILS
HENRY G. KNIGHT, CHIEF
A. G. Mc CALL, CHIEF, SOIL INVESTIGATIONS
CURTIS F. MARBUT, IN CHARGE SOIL SURVEY

CORRECTION

The following corrections in spelling were received from the University of Nebraska after the Soil Map had been printed:

Change Klough Lake to Clough Lake; Jorden Lake to Jordan Lake; Ramsay Lake to Ramsey Lake; Monall Lake to Mulhall Lake; Rochford Lake to Rockford Lake; McCarty Lake to McCarthy Lake; Heskett Lake to Hiskett Lake; Goff Lake to Gaff Lake; Brennemen Lake to Brenneman Lake; **Crist Valley to Christ Valley.**

SOIL MAP

GARDEN COUNTY—NORTHERN SHEET

NEBRASKA

STATE SOIL SURVEY
DEPARTMENT OF THE CONSERVATION AND SURVEY DIVISION
UNIVERSITY OF NEBRASKA G. E. CONDRA, DIRECTOR

Thomas D. Rice, Inspector, District 3.
Soils surveyed by Louis A. Wolfanger, in charge, and A. W. Goke, U. S. Department of Agriculture and H. E. Weakley and E. H. Strieter, Nebraska Soil Survey.

Field Operations
Bureau of Soils
1924

U. S. DEPARTMENT OF AGRICULTURE
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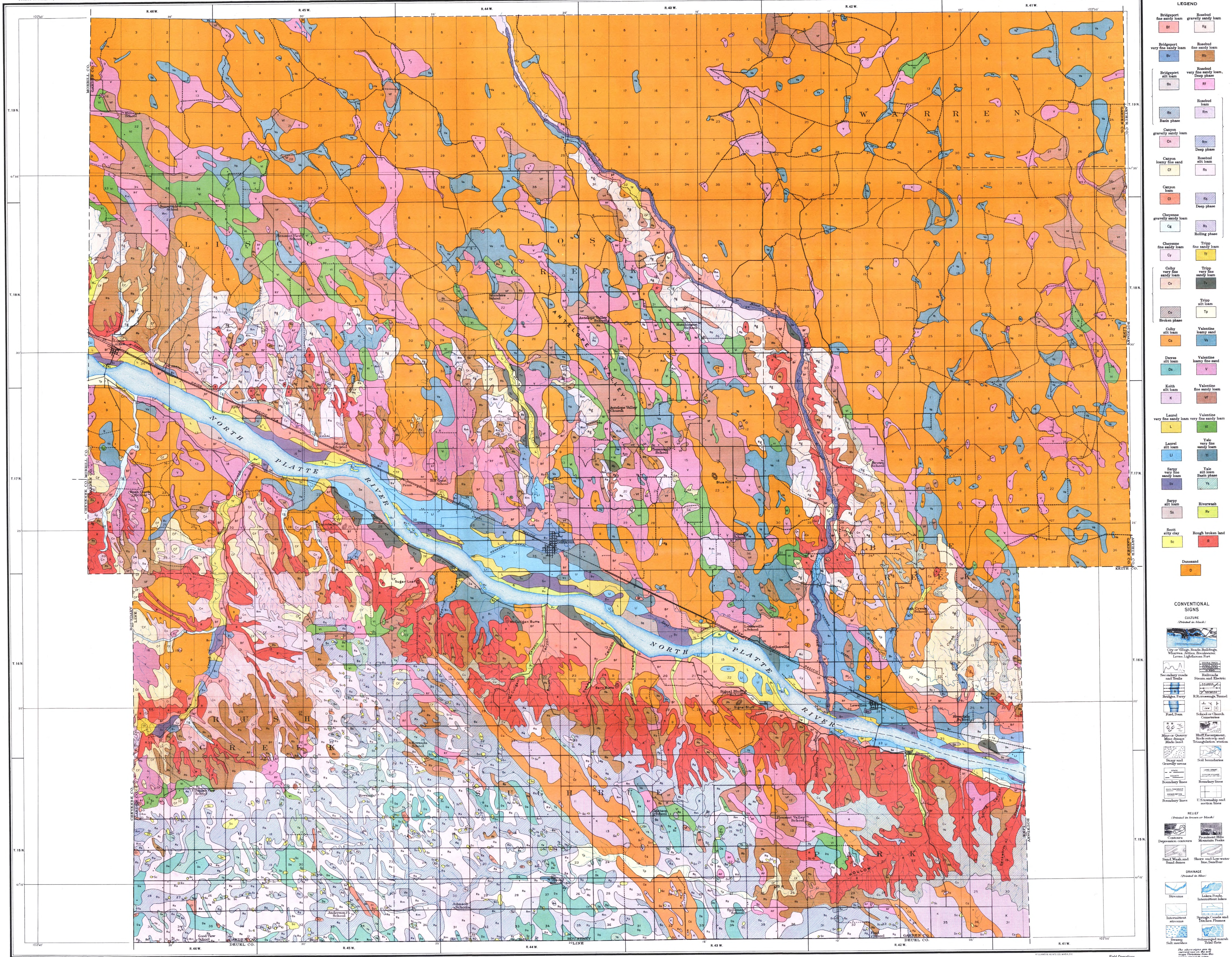
SOIL MAP
GARDEN COUNTY— SOUTHERN SHEET
NEBRASKA

STATE SOIL SURVEY
DEPARTMENT OF THE CONSERVATION AND SURVEY DIVISION
UNIVERSITY OF NEBRASKA G. E. CONDRA, DIRECTOR



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